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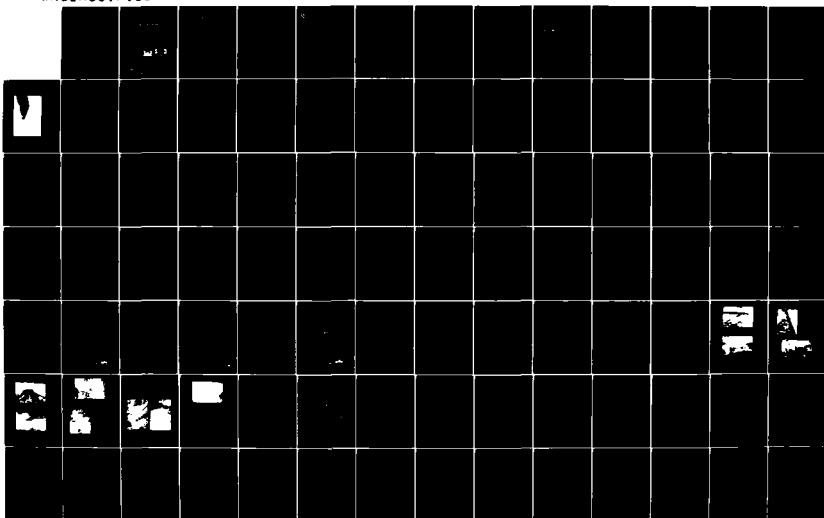
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS  
VONDELL RESERVOIR DAM..(U) CORPS OF ENGINEERS WALTHAM  
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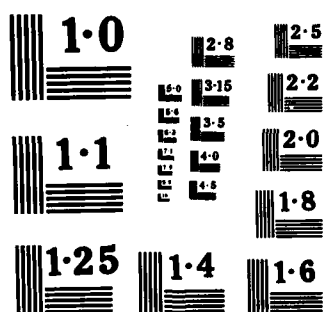
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CONNECTICUT RIVER BASIN  
WOODSTOCK, VERMONT

VONDELL RESERVOIR DAM  
VT 00160

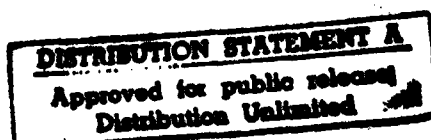
PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS. 02154

OCT., 1980

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER  VT 00160	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle)  Vondell Reservoir Dam  NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED  INSPECTION REPORT
7. AUTHOR(s)  U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Connecticut River Basin Woodstock VT. Vondell Brook		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  ➤The dam is a zoned earthfill embankment structure about 580 ft. long and 33 ft. high. The dam is considered to be in fair condition. No evidence of structural instability was observed. It is small in size with a significant hazard potential. There are a few recommendations which must be undertaken by the owner. ←		



DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
424 TRAPELO ROAD  
WALTHAM, MASSACHUSETTS 02254

REPLY TO  
ATTENTION OF:  
NEDED

MAR 06 1981

Honorable Richard A. Snelling  
Governor of the State of Vermont  
State Capitol  
Montpelier, Vermont 05602

Dear Governor Snelling:

Inclosed is a copy of the Vondell Reservoir Dam (VT-00160) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Water Resources, the cooperating agency for the State of Vermont. In addition, a copy of the report has also been furnished the owner, Woodstock Aqueduct Company, Woodstock, Vermont 05091.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Water Resources for your cooperation in carrying out this program.

Sincerely,

C. E. EDGAR, III  
Colonel, Corps of Engineers  
Division Engineer

Incl  
As stated

VONDELL RESERVOIR DAM

VT 00160

CONNECTICUT RIVER BASIN

WOODSTOCK, VERMONT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

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## BRIEF ASSESSMENT

### PHASE I INSPECTION REPORT

#### NATIONAL PROGRAM OF INSPECTION OF DAMS

Identification Number: VT 00160  
Name of Dam: VONDELL RESERVOIR DAM  
Town: WOODSTOCK  
County and State: WINDSOR COUNTY, VERMONT  
Stream: VONDELL BROOK  
Date of Inspection: AUGUST 5, 1980

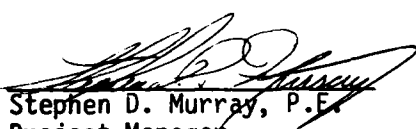
The dam, constructed in 1962, is a zoned earthfill embankment structure approximately 580 feet long and 33 feet in height. The upstream slope is inclined at 3 horizontal to 1 vertical, the downstream slope at 2 horizontal to 1 vertical. A 7 foot long reinforced concrete overflow service spillway exists near the left end of the dam, and an emergency earthen overflow spillway with a crest approximately 60 feet long is cut into the left abutment. Two valved low level outlets, 4 inches, and 8 inches in diameter penetrate the dam at its approximate center and are reported to be operable.

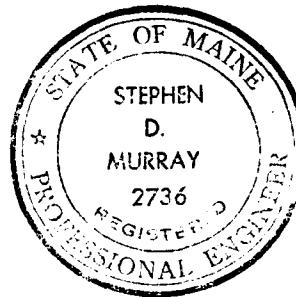
The dam impounds the headwaters of a watercourse locally called Vondell Brook, which flows in a southerly direction about 4600 feet to Cox District Reservoir. The outlet from the Cox Reservoir flows southeasterly about 8600 feet to its confluence with the Ottauquechee River. Vondell Dam was constructed and is used for emergency water supply. The impoundment is 1200 feet in length with a surface area of 7.4 acres. Normal storage capacity is 73 acre-ft.

Based upon the visual inspection and the review of available data regarding this facility, the dam is considered to be in FAIR condition. No evidence of structural instability was observed. Some spalling and cracking of the concrete service spillway was noted, some ruts from mowing activity were apparent on the side slopes, and a shallow trench intended to discourage vehicular trespassing has been dug along a portion of the downstream toe.

In accordance with Corps of Engineers Guidelines and the size (SMALL) and hazard (SIGNIFICANT) classification of the dam, the Test Flood selected was equivalent to the 100-year recurrence flood. Peak inflow to the impoundment is 385 cfs; routed peak outflow from the dam is 320 cfs with the water elevation 2.3 feet below the top of dam. The spillway capacity is 1400 cfs or about 438 percent of the routed Test Flood outflow.

It is recommended that the owner retain a qualified registered engineer to investigate the causes of the concrete cracking of the inlet structure and to design corrective measures; to design a means to eliminate the pressure conduit through the dam core; to supervise tree removal and backfill operations and to perform inspections of the emergency spillway. This and remedial measures which are discussed in Section 7 should be instituted within one year of the owner's receipt of this report.

  
Stephen D. Murray, P.E.  
Project Manager  
James W. Sewall Company

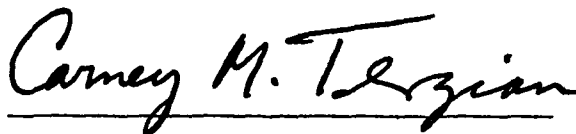


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This Phase I Inspection Report on Vondell Reservoir Dam (VT-00160) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.



ARAMAST MAHTESIAN, MEMBER  
Geotechnical Engineering Branch  
Engineering Division

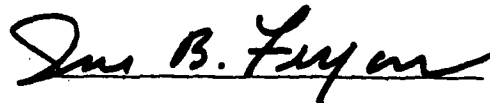


CARNEY M. TERZIAN, MEMBER  
Design Branch  
Engineering Division



JOSEPH W. FINEGAN, JR., CHAIRMAN  
Water Control Branch  
Engineering Division

APPROVAL RECOMMENDED:



JOE B. FRYAR  
Chief, Engineering Division

## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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## SECTION 5: EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

### 5.1 GENERAL

The project is basically a low surcharge-high spillage earthfill dam, originally constructed and currently used to impound water for municipal water supply purposes.

The tributary watershed consists of 0.65 square miles of undeveloped terrain, virtually 100% wooded and containing no significant storage other than Vondell Reservoir. Vondell Reservoir has a surface area of 7.4 acres constituting less than 2% of the total drainage area. With NGVD elevations ranging from 1,140 feet to over 1,600 feet and an average slope of nearly 11%, the watershed is considered mountainous.

Vondell Reservoir Dam is an earth embankment equipped with a 7 foot long overflow service spillway and a 60 foot long emergency spillway crest 2 feet higher. Total spillway discharge capacity is about 438% of the routed Test Flood outflow.

### 5.2 DESIGN DATA

No design data are known to exist for this project.

### 5.3 EXPERIENCE DATA

The maximum known flood at the dam site reportedly occurred June 30, 1973. No specific information concerning this occurrence was located. No information on serious problem situations arising at the dam were found, and it does not appear the dam has been overtopped.

### 5.4 TEST FLOOD ANALYSIS

The "Recommended Guidelines for Safety Inspection of Dams" presents a test flood range for significant hazard small size dams of the 100 year frequency to one-half the Probable Maximum Flood (PMF). Selection of the test flood to be utilized in the analysis of a particular dam is dependent upon the proximity of the dam to the upper or lower limits of its size category. Because the dam is near the lower limits of its size category, the test flood selected is equivalent to the 100 year frequency flood. The magnitude of this flood was estimated utilizing Weather Bureau projections of the ratio of the 100 year frequency precipitation to the probable maximum precipitation as presented in U.S. Department of Commerce T.P. #40 and applying that ratio to the PMF. The tributary watershed consists of 0.65 square miles of steep undeveloped terrain, virtually 100% wooded. Extrapolating from the curve for "mountainous" watersheds contained in the "Preliminary Guidance for Estimating Maximum Probable Discharge", dated March, 1978, peak inflow to Vondell Reservoir is 385 cfs. Routed Test Flood outflow, with the pool initially at normal level (el. 102.5 assumed datum) is 320 cfs with the service spillway overtopped 3.2 feet or 2.3 feet below the top of the dam. Based upon hydraulics computations, the combined capacity of the spillways is 1400 cfs, which is approximately 438% of the routed Test Flood outflow at the top of the dam.

## SECTION 4: OPERATIONAL AND MAINTENANCE PROCEDURES

### 4.1 OPERATIONAL PROCEDURES

a. General - No formal operating procedure, as such, is known to exist. Vondell Reservoir impounds supplementary water for Cox Reservoir downstream. There is no pipe connection between the two. If water is needed in Cox Reservoir, either the 4 inch or 8 inch outlet valves of Vondell are opened and water flows down the streambed to Cox Reservoir.

b. Warning System - No warning system is known to exist.

### 4.2 MAINTENANCE PROCEDURES

a. General - As far as could be determined, the dam receives no regular maintenance. It is presumed that the cutting of the vegetative cover is on an irregular basis.

b. Operating Facilities - No formal plan for the maintenance of operating facilities was disclosed.

### 4.3 EVALUATION

The operation and maintenance procedures at this dam are inadequate to ensure that all problems encountered can be remedied within a reasonable period of time. The owner should establish a written operation and maintenance procedure as well as a downstream warning system to follow in the event of an emergency at the dam.

Erosion could occur along the ruts on the slopes and crest of the dam and the right wing wall of the emergency spillway during surface runoff.

If the small trees and bushes along the right training wall of the emergency spillway are allowed to remain the resulting root systems could create seepage paths which could lead to internal erosion of the dam.

The bushes and trees growing in and overhanging the spillway and outlet channels could restrict the flow of water discharged into the channels.

Continued cracking and spalling of the concrete of the inlet structure could endanger its stability.

The 4 inch and 8 inch diameter outlet pipes are uncontrolled pressure conduits under the center of the dam. The overflow spillway is potentially subject to erosion because of its curvature and steep slope.

A 6 inch diameter corrugated metal pipe exits at the downstream toe of the dam at about Sta 3+30. The pipe, shown in Photo 9, is apparently the outlet pipe from the downstream toe drain in the dam.

A trench had been excavated prior to the time of inspection at the downstream toe of the dam between about Sta 4+20 and Sta 5+30, Photo 10. The purpose of this trench, as determined from the owner, was to discourage vehicular trespass on the dam face. The trench was about 4 feet wide and 3 feet deep. As shown in Photo 10, water was observed seeping into the trench at about Sta 5+30. The soil in the bottom of the trench was soft and wet.

c. Appurtenant Structures

Emergency Spillway

A grass-covered emergency spillway is located in the left abutment to the left of the service spillway inlet. The inlet to the emergency spillway is shown in Photo 11. The embankment forms the right training wall and the left abutment forms the left training wall for the spillway. As shown in Photo 11 the right training wall, which is part of the embankment, is covered with bushes and small trees. Ruts due to vehicular traffic were observed on the right slope of the training wall, as seen in Photo 11.

d. Reservoir Area - There are no indications of instability along the banks of the reservoir in the vicinity of the dam.

e. Downstream Channel - There are two downstream channels, one downstream from the emergency spillway and the other downstream from the outlet pipes. The two downstream channels are referred to as the spillway channel and the outlet channel, respectively, in the following sections. The two channels join about 100 feet downstream of the dam.

The floor of the spillway channel is grass-covered as shown in Photo 11. Bushes and trees are growing in the channel at its end, where it joins the outlet channel.

The floor of the outlet channel is covered with boulders. Grass is growing over the outlet pipes, and bushes and trees are overhanging the channel as shown in Photo 8.

3.2 EVALUATION

On the basis of the results of the visual inspection, Vondell Reservoir dam is judged to be in fair condition.

The trench excavated at the downstream toe of the dam, if allowed to remain open, could result in seepage conditions which could lead to internal erosion of the dam.

## SECTION 3 - VISUAL INSPECTION

### 3.1 FINDINGS

a. General - At the time of inspection on August 5, 1980, the water level in Vondell Reservoir, impounded by the dam, was one inch over the spillway. The weather was hot and humid. The general condition of this dam is fair.

b. Dam - The dam consists of an earth embankment with approximately 2 horizontal to 1 vertical downstream and 3 horizontal to 1 vertical upstream slopes. A vegetated emergency spillway is located on the left abutment immediately adjacent to the dam.

#### Upstream Slope

The upstream slope of the dam is grass-covered as shown in Photo 1. No riprap was observed on the slope. Minor erosion was observed on the upstream slope at the reservoir elevation.

The inlet structure for the service spillway, shown in Photo 2, is located on the upstream slope of the dam at the left end of the dam. Some cracking and spalling of the concrete has occurred as shown in Photo 3. Adjacent to the left side of the inlet structure there is a small depression in the back-fill as shown in Photo 4.

#### Crest

The crest of the dam is about 12 feet wide and covered with grass which has been recently mowed, Photo 5. Ruts due apparently to the mowing equipment or other vehicular traffic, were observed on the crest.

#### Downstream Slope

The downstream slope is grass-covered as shown in Photo 6. The grass had been recently mowed. Ruts, due apparently to the mowing equipment, were observed on the downstream slope. No evidence of seepage, sloughing or erosion was visible.

A valve chamber is located on the downstream slope at about Sta 3+10 as shown in Photo 6. (The station numbers referred to in the following sections were obtained from Gratiot Engineering Co. Drawing No. 5-137,D-3, titled "General Arrangement" and dated April 6, 1962.) The valve chamber contains the controls for a 4 inch diameter outlet pipe and 8 inch diameter outlet pipe which pass through the dam and exit at the downstream toe of the dam at about Sta 3+00 where they discharge into an outlet channel, Photo 7.

The 54 inch diameter service spillway outlet pipe discharges into the outlet channel at the downstream toe of the dam at about Sta 2+90 as shown in Photo 8.

## SECTION 2: ENGINEERING DATA

### 2.1 DESIGN

a. Available Data - Available data consists of five sheets by the Gratiot Engineering Company, Woodstock, Vermont; Vondell Reservoir General Arrangement Drawing D-3; Stripped Foundation Plan and Sections Drawing D-4; Outlet Works Details Drawing D-5; Service Spillway Details Drawing D-6 and Miscellaneous Details Drawing D-7. All sheets are dated April, 1962.

b. Design Features - The drawings, computations and inspection reports indicate the design features stated in Section 1.

c. Design Data - Design data consists of information on the drawings by the Gratiot Engineering Company, as listed in "Available Data".

### 2.2 CONSTRUCTION

a. Available Data - Information as contained in any plans, drawings, or specifications previously listed in "Design Data" or Appendix B.

b. Construction Considerations - Correspondence in the files of the Vermont Water Resources Board indicates that during construction of the dam, a slab footing under the service spillway inlet was made necessary by the failure to encounter ledge as expected. The length of the spillway pipe was reduced from 208 feet to 192 feet.

### 2.3 OPERATION

Pond level readings are not taken on any regular schedule. No formal operation procedures are known to exist.

### 2.4 EVALUATION

a. Availability - Existing data was provided by the State of Vermont Agency of Environmental Conservation.

b. Adequacy - Detailed hydrologic/hydraulic data were not available. Design data and field measurements were utilized in conjunction with New England Division - Army Corps of Engineers "Preliminary Guidance for Estimating Maximum Probable Discharges" to perform the computations of outflow capacity.

The detailed engineering data required to perform an in-depth stability analysis of the dam was not available. The final assessment of the dam, therefore, must be based primarily on visual inspection, performance history, and spillway capacity computations.

c. Validity - A comparison of records, data, and visual observations reveals no significant discrepancies, other than those noted above, between design and as-built dimensions.

	<u>Service</u>	<u>Emergency</u>
6. Downstream channel:	Original streambed	Earthen Channel to streambed
7. General:	N/A	N/A
j. <u>Regulating Outlets</u>		
1. Invert:		80
2. Size:		1 - 8" dia., 1 - 4" dia.
3. Description:		2 C.I. low level drains
4. Control mechanism:		Manually operated gate valves
5. Other:		N/A

f. Reservoir Surface

- |                        |           |
|------------------------|-----------|
| 1. Normal pool:        | 7.4 acres |
| 2. Flood control pool: | N/A       |
| 3. Spillway crest:     | 7.4 acres |
| 4. Test flood pool:    | 8.5 acres |
| 5. Top of dam:         | 9 acres   |

g. Dam

- |                     |  |
|---------------------|--|
| 1. Type:            | Zoned Earthfill                          |
| 2. Length:          | 580± ft                                  |
| 3. Height:          | 33± ft                                   |
| 4. Top Width:       | 12 ft                                    |
| 5. Side Slopes:     | 3H to 1V Upstream<br>2H to 1V Downstream |
| 6. Zoning:          | Shell, Core,<br>and Drain                |
| 7. Impervious Core: | to el. 108                               |
| 8. Cutoff:          | Trench                                   |
| 9. Grout Curtain:   | N/A                                      |
| 10. Other:          | N/A                                      |

h. Diversion and Regulating Tunnel

i. Spillway

- |                      | <u>Service</u>       | <u>Emergency</u> |
|----------------------|----------------------|------------------|
| 1. Type:             | Concrete<br>Overflow | Earthen          |
| 2. Length of weir:   | 7 ft                 | 60 ft            |
| 3. Crest el.         | 102.5                | 104.5            |
| 4. Gates:            | N/A                  | N/A              |
| 5. Upstream channel: | N/A                  | N/A              |

8. Total project discharge at top of dam el. 108: 1410 cfs
9. Total project discharge at test flood el. 105.7: 330 cfs
- c. Elevation (Feet, assumed datum)  
(Elevation 102.5 assumed datum is between elevation 1,130 feet and 1,140 feet NGVD)
1. Streambed at toe of dam: 75
2. Bottom of cutoff: 68<sub>+</sub>
3. Maximum tailwater: N/A
4. Recreation pool: 102.5
5. Full flood control pool: N/A
6. Spillway crest (Ungated): 102.5
7. Design surcharge (original design): 105.1<sub>+</sub>
8. Top of dam: 108
9. Test flood surcharge: 105.7
- d. Reservoir
1. Length of normal pool: 1200<sub>+</sub> ft
2. Length of flood control pool: 1200<sub>+</sub> ft
3. Length of spillway crest pool: 1200<sub>+</sub> ft
4. Length of pool at top of dam: 1200<sub>+</sub> ft
5. Length of test flood pool: 1200<sub>+</sub> ft
- e. Storage
1. Normal pool: 73 acre-ft
2. Flood control pool: N/A
3. Spillway crest pool: 73 acre-ft
4. Top of dam: 114 acre-ft
5. Test flood pool: 92 acre-ft

g. Purpose of Dam - Municipal water storage.

h. Design and Construction History - The following information is believed to be accurate, based upon plans and correspondence available and from conversations with persons familiar with the history of the dam. The dam was designed for the present owner in 1962 by the Gratiot Engineering Company, Woodstock, Vermont. A public hearing, as required by the state, was held April 10, 1962, and a Hearing Order issued June 1, 1962, allowing the project to proceed to construction. Construction was completed in 1963. No unusual construction problems or conditions are known to have been encountered.

i. Normal Operational Procedures - The low level outlets are normally closed and water is allowed to spill over the service spillway. Under drought conditions, or in the event of problems with the gravel-packed well water supply, the low level outlets may be opened and the reservoir content allowed to flow into the downstream Cox Reservoir. Thus, no operational procedures exist other than regular checking.

1.3 PERTINENT DATA

a. Drainage Area - 0.65 square miles of moderately steep, undeveloped terrain which is virtually 100% wooded.

b. Discharge at Dam Site - Discharge is from a reinforced concrete overflow service spillway and from an earthen overflow emergency spillway at higher flows. Elevations are in feet and are referenced to an assumed datum as shown on the design drawings. (Normal pool elevation 102.5 is approximate elevation 1,130 - 1,140 feet NGVD).

1. Outlet Works (conduits) capacity at top of dam el. 108:

	<u>4"</u>	<u>8"</u>
Two cast iron low level drains, 4" and 8" @ invert el. 80 (normally closed):	1 cfs	9 cfs

2. Maximum known flood at dam site:

N/A	N/A
-----	-----

	<u>Service</u>	<u>Emergency</u>
3. Ungated spillway capacity at top of dam el. 108:	300 cfs	1,100 cfs
4. Ungated spillway capacity at test flood el. 105.7:	130 cfs	190 cfs
5. Gated spillway capacity at normal pool el. 102.5:	N/A	N/A
6. Gated spillway capacity at test flood el. 105.7:	N/A	N/A
7. Total spillway capacity at test flood el. 105.7:	130 cfs	190 cfs

The earthen emergency spillway has a crest elevation of about 104.5 and a crest length of about 60 feet. The spillway has side slopes of 3 horizontal to 1 vertical, and curves to intersect the original brook bed some 100 feet from the dam toe.

Two valved low level outlets, 4 inches and 8 inches in diameter penetrate the dam at its approximate center with the upstream inverts at about elevation 80. Valve boxes for these are on the downstream slope.

Elevations are referenced to an assumed datum as shown on the design drawings for the dam. ( Normal pool elevation 102.5 is approximate elevation 1,130 - 1,140 feet NGVD).

No instrumentation exists at this dam.

c. Size Classification - SMALL - The dam impounds 114 acre-feet of water with the pond level at the top of the dam, which at elevation 108 (assumed datum) is 33 feet above the original streambed. With storage between 50 acre-feet and 1000 acre-feet and height between 25 feet and 40 feet, the dam falls into the small category of both criteria and is thus classified small in size according to the Recommended Guidelines.

d. Hazard Classification - SIGNIFICANT - If the dam were breached, there is potential for considerable property damage and loss of no more than a few lives. Three light duty roads between the dam and Cox District Reservoir Dam about 4600 feet downstream would be inundated by the pre-failure flow and further submerged by the breach outflow. The flood wave would overtop the Cox Reservoir Dam by about 7 feet, flooding two downstream residences to a depth of 3 or 4 feet, endangering a few lives. Overtopping of this magnitude would likely induce failure of the Cox Reservoir, increasing downstream flooding depth.

e. Ownership - Woodstock Aqueduct Company  
East Woodstock, Vermont 05091  
(802) 457-3040

Owner Contact:  
Mr. Robert W. Hazen, V.P.  
Dana Insurance Agency  
9 Central Street  
Woodstock, Vermont 05091  
(802) 457-1422

The dam was built by its present owner.

f. Operator - Mr. Avery Colston  
Woodstock Aqueduct Company  
East Woodstock, Vermont 05091  
(802) 457-3040

## PHASE I INSPECTION REPORT

### VONDELL RESERVOIR DAM

#### SECTION 1 - PROJECT INFORMATION

##### 1.1 GENERAL

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. James W. Sewall Company has been retained by the New England Division to inspect and report on selected dams in the State of Vermont. Authorization and notice to proceed were issued to James W. Sewall Company under a letter of April 2, 1980 from William E. Hodgson, Jr. Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0051 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.
2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.
3. To update, verify and complete the National Inventory of Dams.

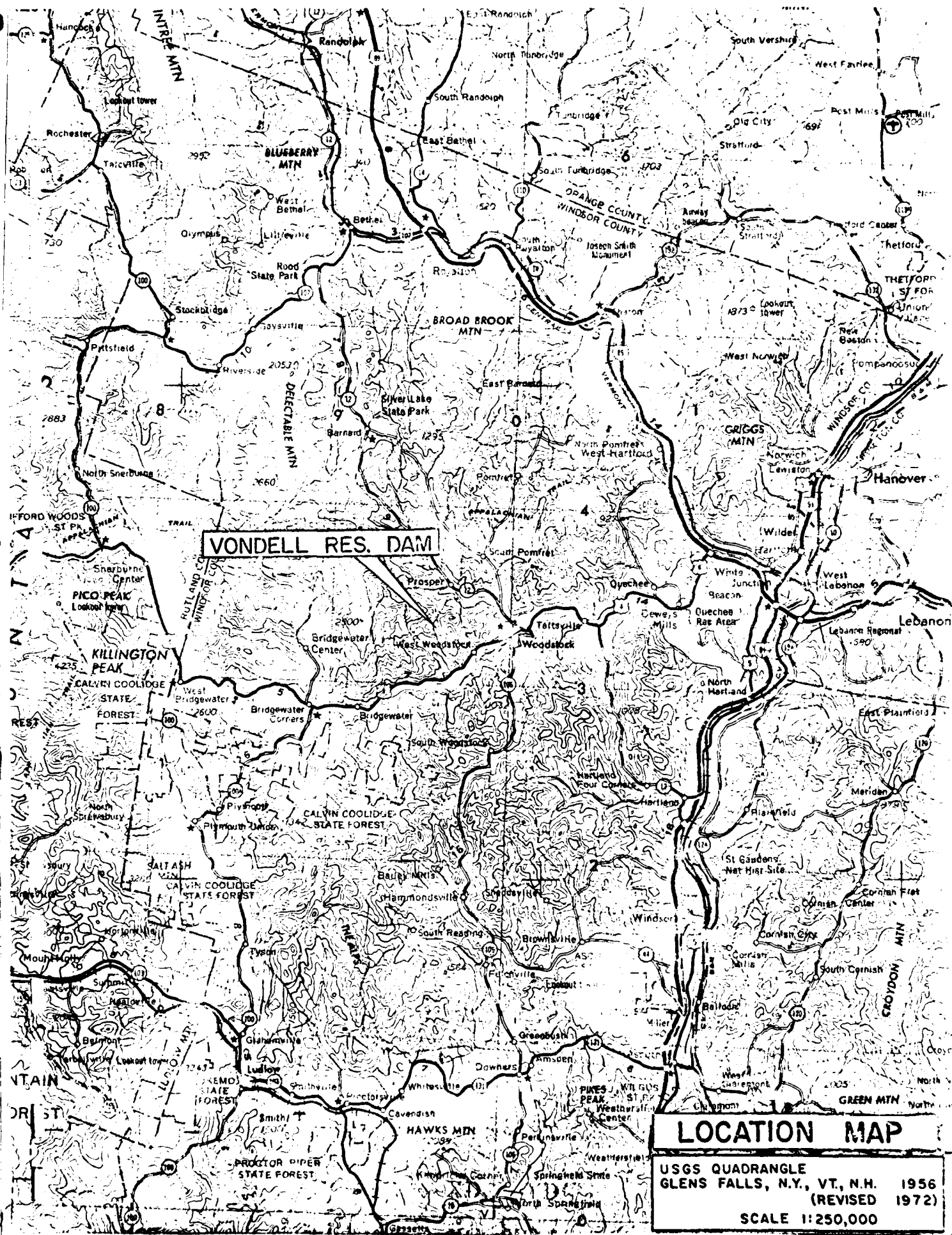
##### 1.2 DESCRIPTION OF PROJECT

a. Location - The dam is located on the headwaters of Vondell Brook about 2.5 miles upstream from its confluence with the Ottauquechee River in a rural area of the Town of Woodstock, County of Windsor, State of Vermont. The dam is shown on the Woodstock North 7.5 minute USGS Quadrangle Map having coordinates latitude N 43° 37.7' and longitude W 72° 34.3'.

b. Description of Dam and Appurtenances - The dam, constructed in 1962, is a zoned earthfill embankment having a total length of approximately 580 feet. A 7 foot long reinforced concrete overflow service spillway exists near the left end of the dam, and an emergency earthen overflow spillway approximately 60 feet wide is cut into the left abutment.

The embankment has a top elevation of approximately 108, is 33 feet in height above the streambed and is 12 feet wide at the crest. The upstream slope is inclined at 3 horizontal to 1 vertical. The downstream slope is inclined at 2 horizontal to 1 vertical and is provided with a drainage blanket and toe drain system.

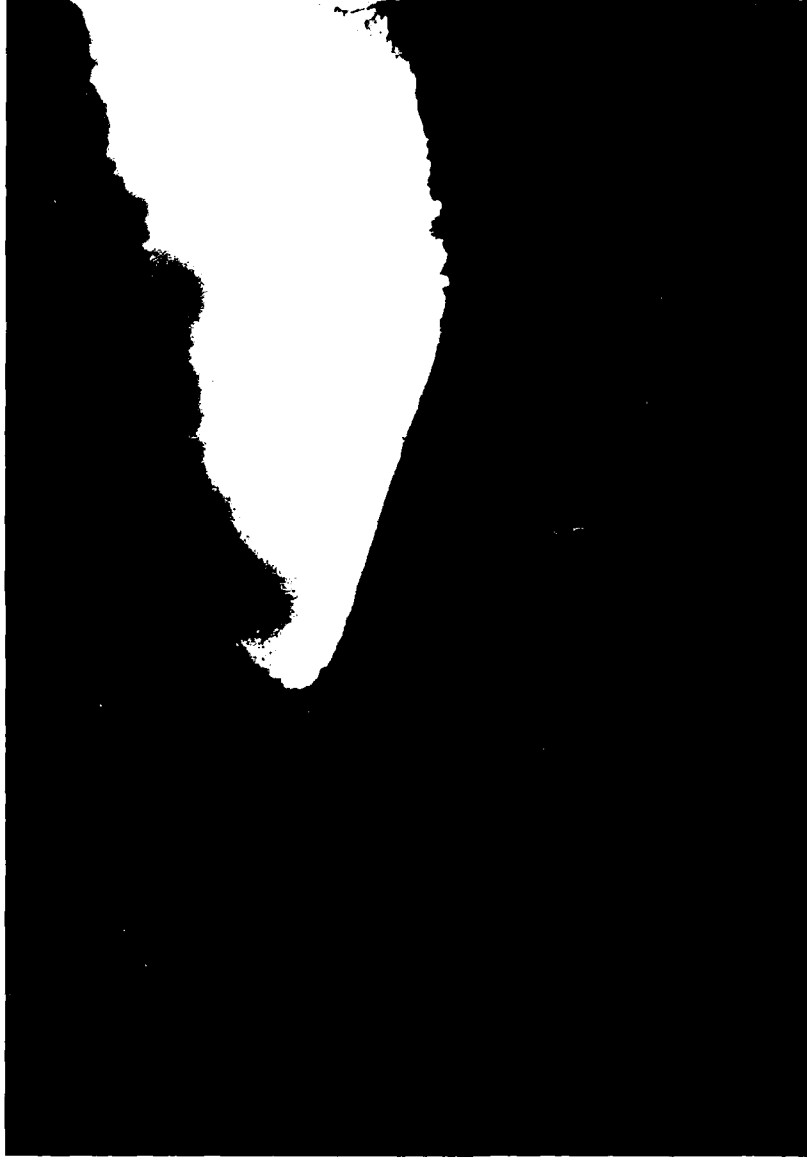
The structure containing the service spillway is a reinforced concrete box pentagonal in plan, four sides being at approximate elevation 107. The fifth side, the service spillway, has a crest length of approximately 7 feet at an elevation of about 102.5. The service spillway is ogee in cross-section. The service spillway outlet pipe is 54 inch reinforced concrete 192 feet long with the upstream invert at approximate elevation 97.



VONDELL RES. DAM

# LOCATION MAP

USGS QUADRANGLE  
GLEN'S FALLS, N.Y., VT, N.H. 1956  
(REVISED 1972)  
SCALE 1:250,000



OVERVIEW PHOTO

U.S. ARMY ENGINEER DIV. NEW ENGLAND  
CORPS OF ENGINEERS  
WALTHAM, MASSACHUSETTS

JAMES W. SEWALL COMPANY  
CONSULTANTS  
OLD TOWN, MAINE

NATIONAL PROGRAM OF  
INSPECTION OF  
NON-FED. DAMS

Vondell Reservoir Dam - VT 00160

Woodstock, Vermont

April 22, 1980

## 5.5 DAM FAILURE ANALYSIS

Utilizing the April, 1978, "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", the peak failure outflow with the pool initially at the top of the dam (el. 108 assumed datum) would be approximately 30,700 cfs. A breach of the dam would result in a rise in stage of 6.5 feet at a light duty road crossing about 3000 feet downstream which would further damage the road, submerged about 2 feet by the pre-failure flow. Further downstream, about 4500 feet below the dam, a light duty town road, overtopped 2.5 feet by the pre-failure flow, would be further damaged by a sudden 3 foot increase in stage. A third light duty roadway about 4600 feet from the dam and immediately upstream from Cox Reservoir, overtopped about 4.5 feet by the pre-failure flow, would be flooded 2 feet deeper by the breach. A 1979 Phase I Inspection Report for Cox District Reservoir Dam VT 00234, indicates the Cox Dam would be overtopped 0.6 feet by a test flood of 550 cfs. The routed Vondell Dam failure flow of 8100 cfs would cause overtopping of the Cox dam, by about 7 feet, and downstream flooding of two residences to a depth of 3 or 4 feet and a possible loss of lives. This magnitude of overtopping would likely fail the Cox dam, increasing the magnitude of downstream flooding. Because of the potential for loss of a few lives and the considerable downstream damage which would ensue from a breach (primarily downstream of Cox Dam), Vondell Reservoir Dam is classified as a "Significant Hazard" dam.

## SECTION 6: EVALUATION OF STRUCTURAL STABILITY

### 6.1 VISUAL OBSERVATION

The visual inspection did not disclose any immediate stability problems; however, the following potential structural concerns were noted:

1. The trench excavated at the downstream toe of the dam could result in seepage conditions leading to internal erosion of the dam if the trench is allowed to remain open.
2. Ruts on the slopes and crest of the dam and on the right training wall of the emergency spillway are potential sources of erosion due to surface runoff.
3. The roots of the trees growing on the right training wall of the emergency spillway could lead to internal erosion of the dam if continued growth of the trees is permitted.
4. Trees and bushes growing in and overhanging the spillway and outlet channels could restrict the flow of water discharged into the channels.
5. Continued cracking and spalling of the concrete of the inlet structure could endanger its stability.
6. Location of the valve boxes on the downstream slope indicates a pressure conduit condition through the impermeable core of the dam, an undesirable and potentially hazardous situation as there would be no way to control a pipeline leak occurring within the dam.

### 6.2 DESIGN AND CONSTRUCTION DATA

No original design and construction data are available for the dam.

### 6.3 POST-CONSTRUCTION CHANGES

The trench at the downstream toe of the dam was excavated after the construction of the dam.

### 6.4 SEISMIC STABILITY

The dam is located in Seismic Zone 2, and in accordance with the recommended Phase 1 guidelines does not warrant seismic investigation.

## SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

### 7.1 DAM ASSESSMENT

a. Condition - Based upon the visual inspection, the dam is judged to be in good condition.

b. Adequacy of Information - Due to the lack of design and construction data for this dam, the assessment of safety is based solely on the visual inspection.

c. Urgency - The remedial measures and recommendations presented below should be implemented by the owner within 1 year after receipt of this Phase I Inspection Report, except as noted in Section 7.3.

### 7.2 RECOMMENDATIONS

The owner should engage a qualified registered engineer to provide technical assistance as follows:

a. Investigate the causes of concrete cracking on the inlet structure and to design corrective measures.

b. Design a means whereby the pressure conduit through the dam core may be eliminated.

c. Supervise removal of trees within 25 feet of the toe of the dam and the backfilling of areas thus excavated with suitable material.

d. Inspect the emergency spillway for evidence of erosion annually, and following each major discharge event.

The owner should implement all recommendations by the engineer.

### 7.3 REMEDIAL MEASURES

a. The trench excavated at the downstream toe of the dam should be backfilled with the excavated material upon receipt of the report by the owner. The material should be placed and compacted in lifts.

b. The ruts on the slopes and crest of the dam and on the right wing wall of the emergency spillway should be backfilled and the areas reseeded, upon receipt of the report by the owner. Formation of ruts should be avoided in the future.

c. Bush and tree growth on the embankment and within 25 feet of the downstream toe should be cut, and new growth cut every two years.

d. A program of annual technical inspection, with repairs as necessary, should be instituted by the owner.

e. A formal downstream warning system to be implemented in the event of an emergency at the dam should be developed by the owner.

f. A formal program of operation and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.

#### 7.4 ALTERNATIVES

This study has identified no practical alternative to the above recommendations.

APPENDIX A  
VISUAL CHECK LIST WITH COMMENTS

# VISUAL INSPECTION CHECKLIST PARTY ORGANIZATION

PROJECT Vandell Reservoir Dam

DATE Aug. 5, 1970

TIME 7:45

WEATHER Partly cloudy

W.S. ELEV. \_\_\_\_\_ U.S. \_\_\_\_\_ DN.S. \_\_\_\_\_

## PARTY:

- |                                      |   |
|--------------------------------------|---|
| 1. <u>Stephen D. Murray</u> S.D.M.   | 6. <u>A. Peter Barranco</u> Vt. Water Resources |
| 2. <u>Robert L. Hanscom</u> R.L.H.   | 7. _____  |
| 3. <u>Charles A. Fienev</u> C.A.F.   | 8. _____  |
| 4. <u>Daniel P. La Gatta</u> D.P.L.  | 9. _____  |
| 5. <u>Stephen L. V. Hires</u> S.L.V. | 10. _____                                       |

## PROJECT FEATURE

## INSPECTED BY

## REMARKS

- |  |   |  |
|--|---|--|
| 1. <u>Dam Embankment</u>                             | <u>D.P.L. S.L.V. S.D.M. R.L.H. C.A.F.</u> |  |
| 2. <u>Intake Structure</u>                           | <u>D.P.L. S.L.V. S.D.M. R.L.H. C.A.F.</u> |  |
| 3. <u>Outlet Structure &amp; Outlet Channel</u>      | <u>D.P.L. S.L.V. S.D.M. R.L.H. C.A.F.</u> |  |
| 4. <u>Emergency Spillway &amp; Discharge Channel</u> | <u>D.P.L. S.L.V. S.D.M. R.L.H. C.A.F.</u> |  |
| 5. _____   |   |  |
| 6. _____   |   |  |
| 7. _____   |   |  |
| 8. _____   |   |  |
| 9. _____   |   |  |
| 10. _____  |   |  |

# PERIODIC INSPECTION CHECKLIST

PROJECT Yonkers Reservoir Dam DATE Aug. 5, 1990  
 PROJECT FEATURE Dam Embankment NAME \_\_\_\_\_  
 DISCIPLINE Soils & Seepage NAME PLM C.A.H.  
Geotechnical Engineers Inc. D.P.L. S.L.V.

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None observed
Pavement Condition	No pavement
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	No misalignment observed
Horizontal Alignment	No misalignment observed
Condition at Abutment and at Concrete Structures	Erosion next to left wall of spillway intake structure.
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	Vehicle tracks on crest and downstream slope
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	No riprap observed
Unusual Movement or Cracking at or Near Toe	110 ft. long trench has been excavated at downstream toe from about Sta. 4+20 to Sta. 5+30.
Unusual Embankment or Downstream Seepage	Water seeping into trench at about Sta. 5+30. Ground upstream of the trench at Sta. 5+30 is wet and spongy.
Piping or Boils	None observed
Foundation Drainage Features	Blanket toe drain with 6 in. outlet pipe
Toe Drains	See above
Instrumentation System	None observed
Vegetation	Grass has been recently cut on crest and upstream and downstream slopes

# PERIODIC INSPECTION CHECKLIST

PROJECT Vonatz Reservoir Dam

DATE Aug. 5, 1980

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE James H. Smith Co.  
Geotechnical Engineers Inc.

NAME S.D.M. F.L.H. S.B.H.  
D.P.L. S.L.W.

AREA EVALUATED	CONDITION
<b>DIKE EMBANKMENT</b> Crest Elevation Current Pool Elevation Maximum Impoundment to Date Surface Cracks Pavement Condition Movement or Settlement of Crest Lateral Movement Vertical Alignment Horizontal Alignment Condition at Abutment and at Concrete Structures Indications of Movement of Structural Items on Slopes Trespassing on Slopes Sloughing or Erosion of Slopes or Abutments Rock Slope Protection - Riprap Failures Unusual Movement or Cracking at or Near Toes Unusual Embankment or Downstream Seepage Piping or Boils Foundation Drainage Features Toe Drains Instrumentation System Vegetation	<p><i>There is no dike on this project</i></p>

PROJECT Vander Reservoir Dam

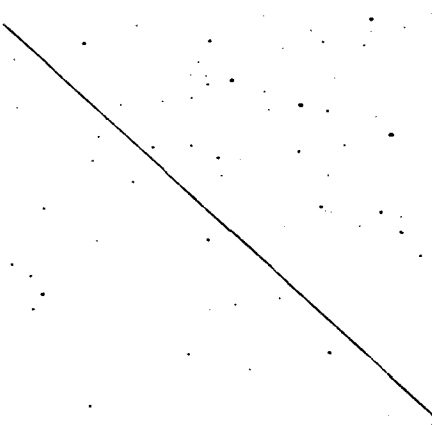
DATE Aug. 5, 1980

PROJECT FEATURE Intake Structure

NAME \_\_\_\_\_

DISCIPLINE James S. Co.  
Geotechnical Engineers Inc.

NAME S.D.M. P.L. C.F.H.  
D.P.L. S.L.V.

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u></p> <p>a. Approach Channel</p> <p>    Slope Conditions</p> <p>    Bottom Conditions</p> <p>    Rock Slides or Falls</p> <p>    Log Boom</p> <p>    Debris</p> <p>    Condition of Concrete Lining</p> <p>    Drains or Weep Holes</p> <p>b. Intake Structure</p> <p>    Condition of Concrete</p> <p>    Stop Logs and Slots</p>	<p><i>Under water - not observed</i></p>  <p><i>Concrete is in fair condition with minor cracks and efflorescence. Top of right wall under steel plate has broken off. Is to be repaired.</i></p>

PERIODIC INSPECTION CHECKLIST

PROJECT Vandell Reservoir Dam

DATE Aug. 5, 1980

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE James W. Sewall Co.  
Geotechnical Engineers Inc.

NAME E.D.M. Smith C.E.H.  
D.P.L. S.L.W.

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - CONTROL TOWER</u></p> <p>a. Concrete and Structural</p> <p>General Condition</p> <p>Condition of Joints</p> <p>Spalling</p> <p>Visible Reinforcing</p> <p>Rusting or Staining of Concrete</p> <p>Any Seepage or Efflorescence</p> <p>Joint Alignment</p> <p>Unusual Seepage or Leaks in Gate Chamber</p> <p>Cracks</p> <p>Rusting or Corrosion of Steel</p> <p>b. Mechanical and Electrical</p> <p>Air Vents</p> <p>Float Wells</p> <p>Crane Hoist</p> <p>Elevator</p> <p>Hydraulic System</p> <p>Service Gates</p> <p>Emergency Gates</p> <p>Lightning Protection System</p> <p>Emergency Power System</p> <p>Wiring and Lighting System</p>	<p><i>There is no control tower</i></p>

## PERIODIC INSPECTION CHECKLIST

PROJECT Vander Pever DamDATE Aug. 5, 1980

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE James L. Selion Co.NAME S.D.M. P.L.H. C.F.T.Geotechnical Engineers Inc.D.P.L. S.L.W.

## AREA EVALUATED

## CONDITION

OUTLET WORKS - TRANSITION AND CONDUIT

General Condition of Concrete

Rust or Staining on Concrete

Spalling

Erosion or Cavitation

Cracking

Alignment of Monoliths

Alignment of Joints

Numbering of Monoliths

See next page

PERIODIC INSPECTION CHECK

PROJECT Vogue Reservoir Dam DATE Aug. 5, 1980  
 PROJECT FEATURE Outlet Structure & Outlet Channel NAME \_\_\_\_\_  
 DISCIPLINE James H. Seaton Co. NAME S.D.M. P.L.L. C.E.T.  
Geotechnical Engineers Inc. D.P.L. S.L.V.

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	The outlet structure is a S.A.M.C. pipe leading from the intake structure to the original brook course at the lower end of the emergency spillway.
Rust or Staining	The pipe is in good condition.
Spalling	None observed.
Erosion or Cavitation	None observed.
Visible Reinforcing	None observed.
Any Seepage or Efflorescence	None observed.
Condition at Joints	Good, no misalignment.
Drain holes	None observed.
Channel	
Loose Rock or Trees Overhanging Channel	Brush growing in channel at discharge pipe and downstream of discharge pipe.
Condition of Discharge Channel	Fair.

# PERIODIC INSPECTION CHECKLIST

PROJECT Vonae Reservoir Dam

DATE Aug. 5, 1970

PROJECT FEATURE Emergency Spillway and Discharge Channel

NAME \_\_\_\_\_

DISCIPLINE James M. Seng Co.  
Geotechnical Engineers Inc.

NAME S.D.M. R.L.H. C.F.H.  
D.P.L. S.L.W.

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u></p> <p>a. Approach Channel</p> <p>General Condition</p> <p>Loose Rock Overhanging Channel</p> <p>Trees Overhanging Channel</p> <p>Floor of Approach Channel</p> <p>b. Weir and Training Walls</p> <p>General Condition of Concrete</p> <p>Rust or Staining</p> <p>Spalling</p> <p>Any Visible Reinforcing</p> <p>Any Seepage or Efflorescence</p> <p>Drain Holes</p> <p>c. Discharge Channel</p> <p>General Condition</p> <p>Loose Rock Overhanging Channel</p> <p>Trees Overhanging Channel</p> <p>Floor of Channel</p> <p>Other Obstructions</p> <p>Other Comments</p>	<p>Not observed - under water</p> <p>Training wall is earth embankment</p> <p>None observed</p> <p>Good</p> <p>None observed</p> <p>None observed</p> <p>Grass covered until end of discharge channel where numerous trees and bushes are growing.</p> <p>Right training wall for channel is grass covered. Motorcycle ruts have been eroded in wall.</p>

PROJECT Varadero Reservoir DamDATE Aug. 5, 1980

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE James W. Sewell Co.  
Geotechnical Engineers Inc.NAME S.D.M. P.L.L. C.A.D.  
D.P.L. S.D.M.

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - SERVICE BRIDGE</u></p> <p>a. Super Structure</p> <p>Bearings</p> <p>Anchor Bolts</p> <p>Bridge Seat</p> <p>Longitudinal Members</p> <p>Underside of Deck</p> <p>Secondary Bracing</p> <p>Deck</p> <p>Drainage System</p> <p>Railings</p> <p>Expansion Joints</p> <p>Paint</p> <p>b. Abutment &amp; Piers</p> <p>General Condition of Concrete</p> <p>Alignment of Abutment</p> <p>Approach to Bridge</p> <p>Condition of Seat &amp; Backwall</p>	<p><i>There is no service bridge</i></p>

WOODSTOCK AQUEDUCT COMPANY  
WOODSTOCK VERMONT

EDWARD G. WELCHMAN, PRESIDENT  
GEORGE C. BROCKWAY, VICE PRES.  
F. S. BILLINGS, JR., SECRETARY

March 5, 1962

Water Conservation Board  
State of Vermont  
State Office Building  
Montpelier, Vermont

Dear Sirs:

We enclose our application for the Construction Permit for a Dam with a copy of the letter which we sent to the Selectmen.

Through the drought that Woodstock had last summer it is imperative, as soon as we can start in the spring, to let out this contract in order to procure additional water facilities. Therefore, our plea to hold your Hearing as soon as possible in order to help us expedite the rendering of this contract.

Your cooperation in this matter will be greatly appreciated, and thanking you, remain

Yours very truly,

Woodstock Aqueduct Company,

  
Edward G. Welchman

EGW:FM

ROUTING		
GENERAL		
TO	INITIALS	DATE
DEC	JEC	3-7
RWT	R	3-23
BY		B-13

INVITATION TO BID

April 23, 1962

Sealed Proposal addressed to The Woodstock Aqueduct Company, Woodstock, Vermont covering the work required for construction of the Vondell Reservoir dam with associated structures, together with a bid bond in the amount of five percent of the total bid, will be received at the office of the corporation in Woodstock, Vermont until 2:30 P.M. on May 16, 1962 and at that time and place will be publicly opened and read aloud.

The project consists of construction of a rolled earthfill dam requiring approximately 23,000 cubic yards of earthfill, 156 feet of 8" cast iron pipe, 210 feet of 54" diameter reinforced concrete pipe for a service spillway, together with such other work as stripping, clearing, excavating, concrete work, valves, and other items to result in a complete operating dam as shown on the drawings.

Contract Documents, specifications, and plans for the proposed work may be examined at the office of The Gratiot Engineering Company, 39 Central Street, Woodstock, Vermont and at the office of the F. W. Dodge Corporation in Manchester, New Hampshire. Copies of these Documents may be obtained from The Gratiot Engineering Company upon payment of ten dollars (\$10.00) for each set. This deposit will be refunded if the Documents are returned in good condition within five days after the opening of bids.

THE GRATIOT ENGINEERING COMPANY

J. Peter Gratiot

June 5, 1962

Mr. Franklin S. Billings, Jr.  
Attorney at Law  
The Green  
Woodstock, Vermont

Dear Bill:

Agreeable to our previous discussions, this office has reviewed a set of plans and specifications for the Vondell Dam and Reservoir as submitted on May 15, 1962. These plans and specifications were found to contain the additions and corrections that were requested by this office. Accordingly, we have stamped this set of drawings and specifications as "Approved", thereby making them the official set for the construction of this project. Should the engineer find it desirable or necessary to deviate from these plans and specifications, proper clearance in writing should be obtained from this office before such changes are made a part of the project.

With best wishes, I am,

Sincerely,

Reinhold W. Thieme, P. E.  
Commissioner of Water Resources

RWT:mls  
Enc. 1 set plans  
1 " specifications

ROUTING		
GENERAL		
TO	NOTED	DATE
RWT	Φ.	6-5
	jic	6-5
SUSPEND TO		
FILE		

B-11

SPECIAL ORDER AND DRAWINGS

CONDELL RESERVOIR  
WOODSTOCK AQUEDUCT COMPANY

CHANGE ORDER #1

SEP 4 1962

1. This change order covers additions and changes to the drawings and specifications. The service spillway conduit has been shortened by two eight foot lengths at the downstream end and the spillway structure supported on a slab footing rather than on ledge, since no ledge was encountered on excavation for the footing.

2. Drawings:

a) Drawing D-1

Change list of drawings to read:

No. D-1	Title Page	Rev. C
D-2	Existing Site Plan and Test Hole Data	Rev. A
D-3	General Arrangement	Rev. J
D-4	Striped Foundation Plan	Rev. F
D-5	Outlet Works Details	Rev. F
D-6	Service Spillway Details	Rev. D
D-7	Miscellaneous Details	Rev. E

b) Drawing D-3

Revisions G, H & J supersede revision F.

c) Drawing D-6

Revisions C & D supersede revision B

d) Drawing D-7

Revision E supersede revision D

3. Specifications:

a) Addendum No. 1

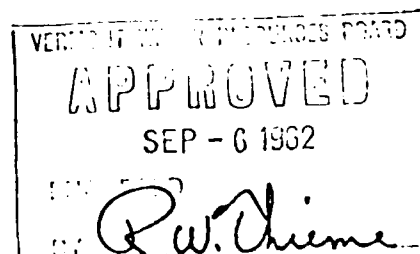
Change item 8 (a) to read:

Length of spillway 54" pipe is changed from 208 feet or 26 eight foot lengths of 54" pipe to 192 feet or 24 eight foot lengths of 54" pipe.

b) Form of Agreement:

Article 1 (a). Change the list of drawing revisions to agree with item 2 above.

P. 1 of 1



THE GRATIOT ENGINEERING COMPANY  
CONSULTING ENGINEERS  
39 CENTRAL STREET - WOODSTOCK, VERMONT  
TELEPHONE 159 & 515

ROUTING		
GENERAL		
TO	NOTED	DATE
JEC	JEC	9-5
DW		9-5
RWT		
September 4, 1962		
RECEIVED TO		
FILE		

September 4, 1962

Water Resources Board  
State Office Building  
Montpelier, Vermont

ATTENTION: Mr. Reinhold Thieme, Commissioner

Re: Vondell Reservoir  
Woodstock Aqueduct Co.  
Change Order #1

Gentlemen:

We attach description and one set of drawings affected by this change on subject job.

The change in length of the service spillway as resulted from a recent field check of the profile. Installation of the slab footing under this spillway inlet was made necessary by failure to find ledge as expected.

We respectfully request that the change shown be approved by your office as modification to the original approved set of documents.

Very truly yours,

THE GRATIOT ENGINEERING COMPANY

J. Peter Gratiot, P.E.

JPG:jj

cc: Woodstock Aqueduct Company

attachment

September 6, 1962

J. Peter Gratiot, P. E.  
The Gratiot Engineering Company  
39 Central Street  
Woodstock, Vermont

Re: Vondell Reservoir  
Woodstock Aqueduct Co.  
Change Order #1

Dear Mr. Gratiot:

Your letter of September 4th enclosing a description and one set of drawings affected by the change on the referenced job is hereby acknowledged.

Mr. Cerutti, Hydraulic Engineer for this office, has reviewed this Change Order and advises me that the changes are satisfactory.

Approval of this office is hereby given for Change Order #1 on the referenced project, said change as described in your letter of September 4th and as shown on the modified drawings furnished therewith. May I suggest that an additional copy of the specification or description and a set of drawings be sent to this office so that they might be stamped "approved" and become part of the record of the Woodstock Aqueduct Company.

Sincerely,

Reinhold W. Thieme, P. E.  
Commissioner of Water Resources

RWT:ms

ROUTING		
GENERAL		
TO	NOTED	DATE
RWT	#	9-6
JEC	JEC	9-6
SUSPEND TO		

B-8

TO	NOTED	DATE
SEC	JEC	1-14
RWT	JP	1-14
SUB. TO		
RE		

THE GRATIOT ENGINEERING COMPANY  
CONSULTING ENGINEERS  
39 CENTRAL STREET • WOODSTOCK, VERMONT

RECEIVED  
TELEPHONE 150 & 515

DEPT. OF WATER RESOURCES  
JAN 10 1963

January 10, 1963

Mr. Edward G. Welchman, President  
The Woodstock Aqueduct Company  
Woodstock, Vermont

Re: Vondell Reservoir

Dear Ed:

This morning Mr. Hazen, Mr. Pumpelly and I visited the Vondell dam to check it for settlement. On November 29, 1962 we had set five pipes along the top of the dam to use as reference points.

This morning's measurements indicate that the earth, where exposed through snow, and the pipes have moved upward approximately 1".

We consider the above increase in ground height consistent with the fact that all but the top few feet of the dam were placed with a degree of compaction in excess of that normally obtained (and in excess of what we specified) with the result that there is apparently no actual settlement but only a small amount of frost heave showing up.

We have discussed this matter with Mr. Cerutti of the Department of Water Resources and he and I are in agreement that it will be entirely in order to start impounding some water behind the dam.

Since the top foot of fill has not been placed on the dam you should not permit the dam to fill to normal spillway height and it is recommended that the water level be maintained at about  $\frac{1}{2}$  to  $\frac{3}{4}$  of the design depth in order to allow some additional storage in the event of a severe storm.

Very truly yours,

THE GRATIOT ENGINEERING COMPANY

*[Signature]*  
J. Peter Gratiot, P.E.

JPG:jj

cc: Water Resources Board

ROUTING		
GENERAL		
TO	NOTED	DATE
JEC	pc	4-16
RWT	PF	4-22
DWW	DWW	4-16

THE GRATIOT-ENGINEERING COMPANY  
CONSULTING ENGINEERS  
39 CENTRAL STREET • WOODSTOCK, VERMONT  
TELEPHONE 802 457-2300

DEPT. OF WATER RESOURCES

April 11, 1963

Mr. Edward G. Welchman, President  
The Woodstock Aqueduct Company  
Woodstock, Vermont

Re: Vondell Reservoir

Dear Ed:

We have not heard anything from the Water Resources Board regarding our request for permission to raise the water level to spillway elevation.

Since making our verbal request to the Water Resources Board we have taken the transit up to the dam and have picked up some detail elevation data. It appears that there has been no significant settlement on the dam. We had driven some iron pipes about 4 feet into the earth on the back side of the crest at five places and those pipes show elevation changes from 1/10 foot of settlement at two locations to 1/10 foot of increase in elevation at two locations and substantially no change at the other. The dam appears to be in good condition but there is at station 4 plus 42 approximately a low point with an elevation only 2.6 feet above service spillway crest. This puts the top of the dam at this location at about the elevation of the water for our design flood condition. In my opinion it is not wise to let the water come up to the spillway elevation until Mr. Sailer has completed his earthwork on the top of the dam. Therefore, until such time as Mr. Sailer can complete his earthwork it is my recommendation that the water level be maintained at an elevation not higher than 3 feet below the service spillway elevation. When Mr. Sailer has completed his earthwork we can ask the State to make an inspection and at that time we can raise the water up to the spillway. In the meantime please keep sufficient outflow to balance the inflow and maintain the water level as indicated above.

Very truly yours,

THE GRATIOT-ENGINEERING COMPANY

J. Peter Gratiot, P.E.

JPG:jj

cc: The Water Resources Board

THE GRATIOT ENGINEERING COMPANY  
CONSULTING ENGINEERS  
39 CENTRAL STREET • WOODSTOCK, VERMONT  
TELEPHONE 802 457-2300

TO	DATE
RWT	10-29
JEC	10-29
DWW	10-29

October 28, 1963

Water Resources Board  
State Office Building  
Montpelier, Vermont

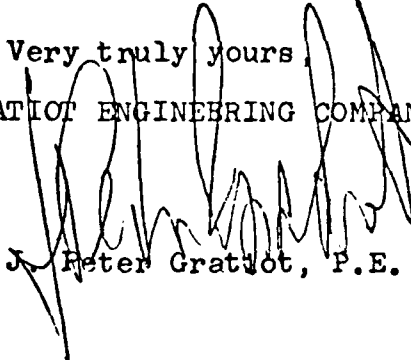
Re: Certificate of Completion  
Vondell Reservoir  
Woodstock Aqueduct Company  
Woodstock, Vermont

Gentlemen:

This is to inform you all work required in connection with the construction of subject reservoir has been completed as of this date and that all parts of this work have been executed in conformity with our designs and under our general supervision.

Very truly yours,

THE GRATIOT ENGINEERING COMPANY

  
J. Peter Gratiot, P.E.

JPG:js

cc: The Woodstock Aqueduct Company

VERMONT DEPARTMENT OF WATER RESOURCES

INFORMATION SHEET

Name of Dam Woodstock Aqueduct Co. (Vandell Res.) Town Woodstock  
 Owner Woodstock Aqueduct Co. Name of Stream Vandell Brook  
 Address 9 Central St. Classification \_\_\_\_\_  
Woodstock, VT.

U.S.G.S. Coordinates: Lat. 43° 40' 37-12 Long. 72° 35' 34-17"

U.S.G.S. Map Woodstock, N.H., Vt. (36-C) Aerial Photos VF-62-H 47-148, 149

U.S.G.S. Elev. @ Spillway \_\_\_\_\_

Total Length of Dam 580' Crest Width of Emergency Spillway 60'

Width of Top 12' Maximum Height 33'

Spillway Capacity: Principal \_\_\_\_\_ Emergency \_\_\_\_\_

Pond Area 82 acres Drainage Area .54 sq mi

Pond Volume: Normal Water Level 411.11 ft Design High Water Level \_\_\_\_\_

Maximum Water Depth: Normal Water Level \_\_\_\_\_ Design High Water Level 28'

Storage Before Emergency Spillway is Used \_\_\_\_\_

Use of Reservoir Water Supply

Description of Dam: Earth fill

Description of Spillway(s): P.S. Service Spilling Pipe inlet 54" conc. pipe  
 E.S. Vegetated

Designed by Grubbs Eng. Co. Year Built 1963

Hearing Date April 10, 1962 Order Date June 1, 1962

Additional Remarks:

SUMMARY OF DATA AND CORRESPONDENCE

<u>DATE</u>	<u>TO</u>	<u>FROM</u>	<u>SUBJECT</u>	<u>PAGE</u>
-	File	-	Vermont Department of Water Resources Information Sheet	B-4
10-28-63	Water Resources Board	Gratiot Engineering Company	Certificate of Completion	B-5
4-11-63	E. G. Welchman	Gratiot Engineering Company	Water level in reservoir	B-6
1-10-63	E. G. Welchman	Gratiot Engineering Company	Water level in reservoir	B-7
9-6-62	J. Peter Gratiot	R. W. Thieme Commissioner Water Resources	Approval of Change Order	B-8
9-4-62	Water Resources Board	Gratiot Engineering Company	Change Order	B-9
6-5-62	Franklin S. Billings	R. W. Thieme Commissioner	Approval of plans	B-11
4-23-62	Public	Gratiot Engineering Company	Invitation to Bid	B-12
3-5-62	Water Con- servation Board	Woodstock Aqueduct Company	Application for Permit	B-13
5-62	-	-	Design Plans - Reduced in Size	B-14

VONDELL RESERVOIR DAM

EXISTING PLANS

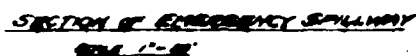
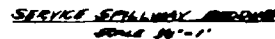
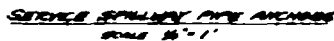
On file with the Vermont Department of Water Resources:

1. Woodstock Aqueduct Co.  
Vondell Reservoir  
Gratiot Engineering Co., Woodstock, Vermont  
Dwg. D-3 General Arrangement, May, 1962  
Dwg. D-4 Stripped Foundation Plan and Sections, May, 1962  
Dwg. D-5 Outlet Works - Details, May, 1962  
Dwg. D-6 Service Spillway Details, May, 1962  
Dwg. D-7 Miscellaneous Details, May, 1962

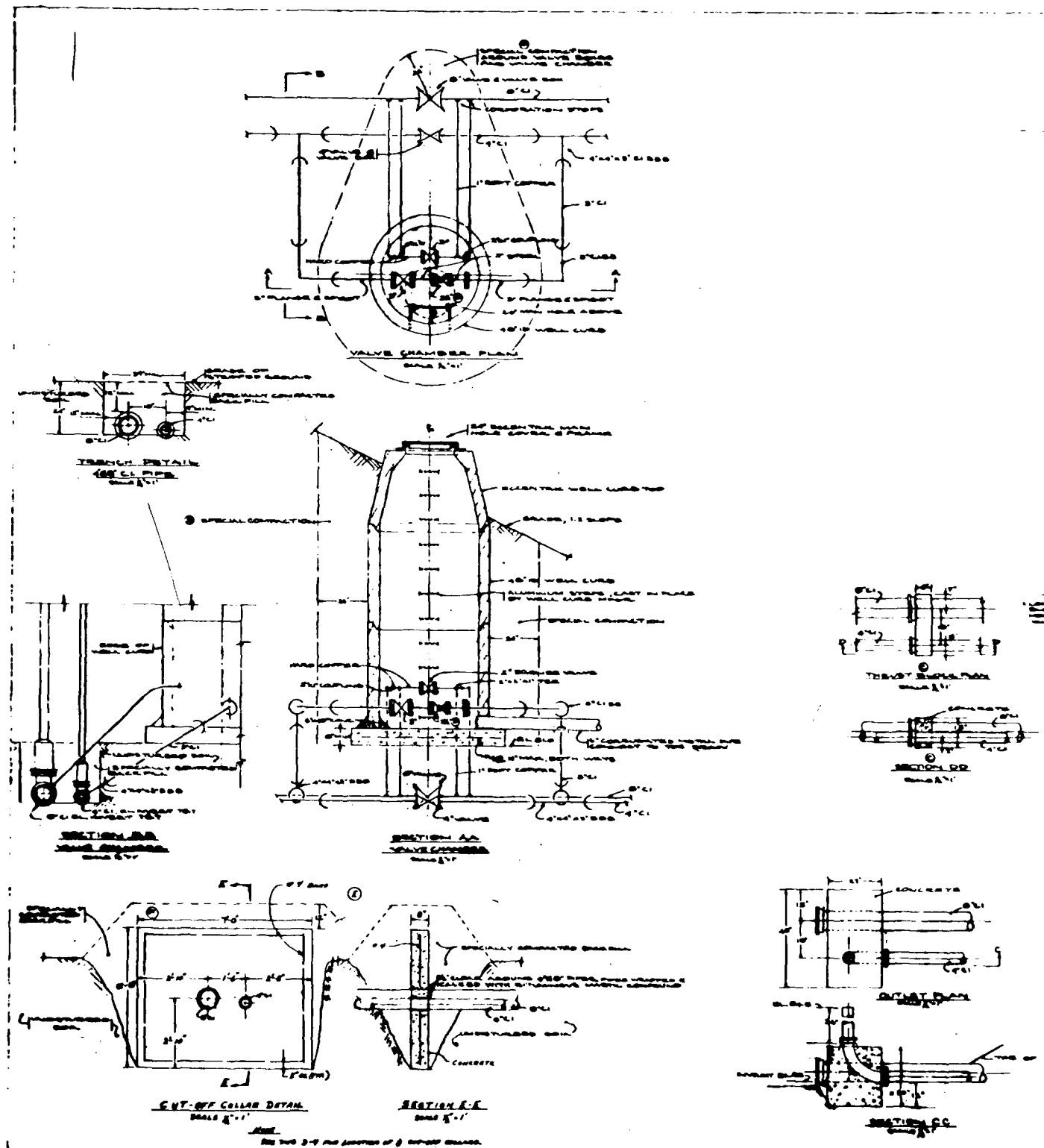


APPENDIX B  
ENGINEERING DATA

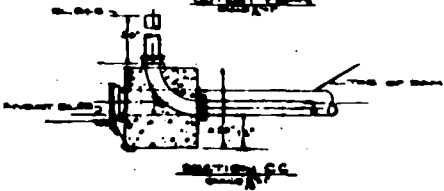
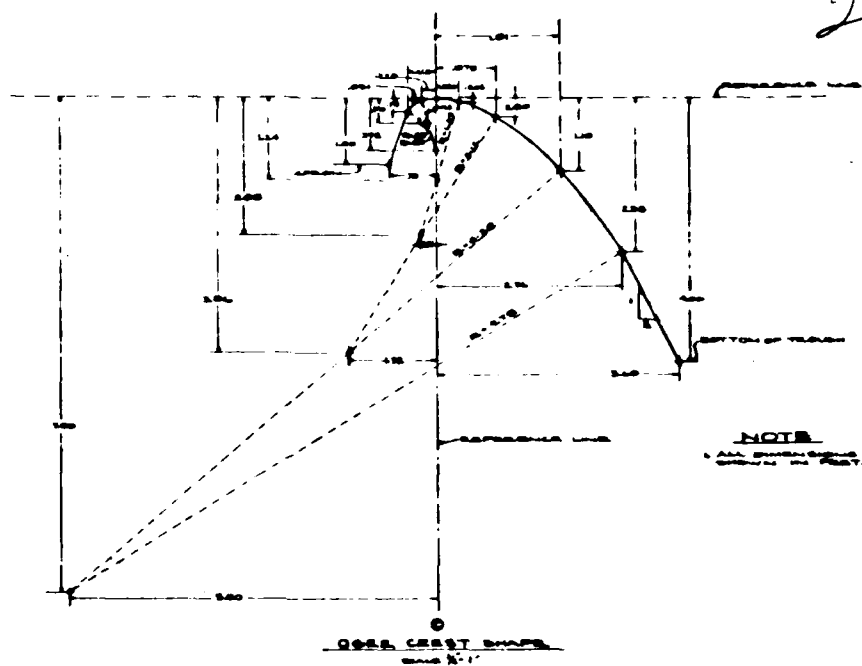
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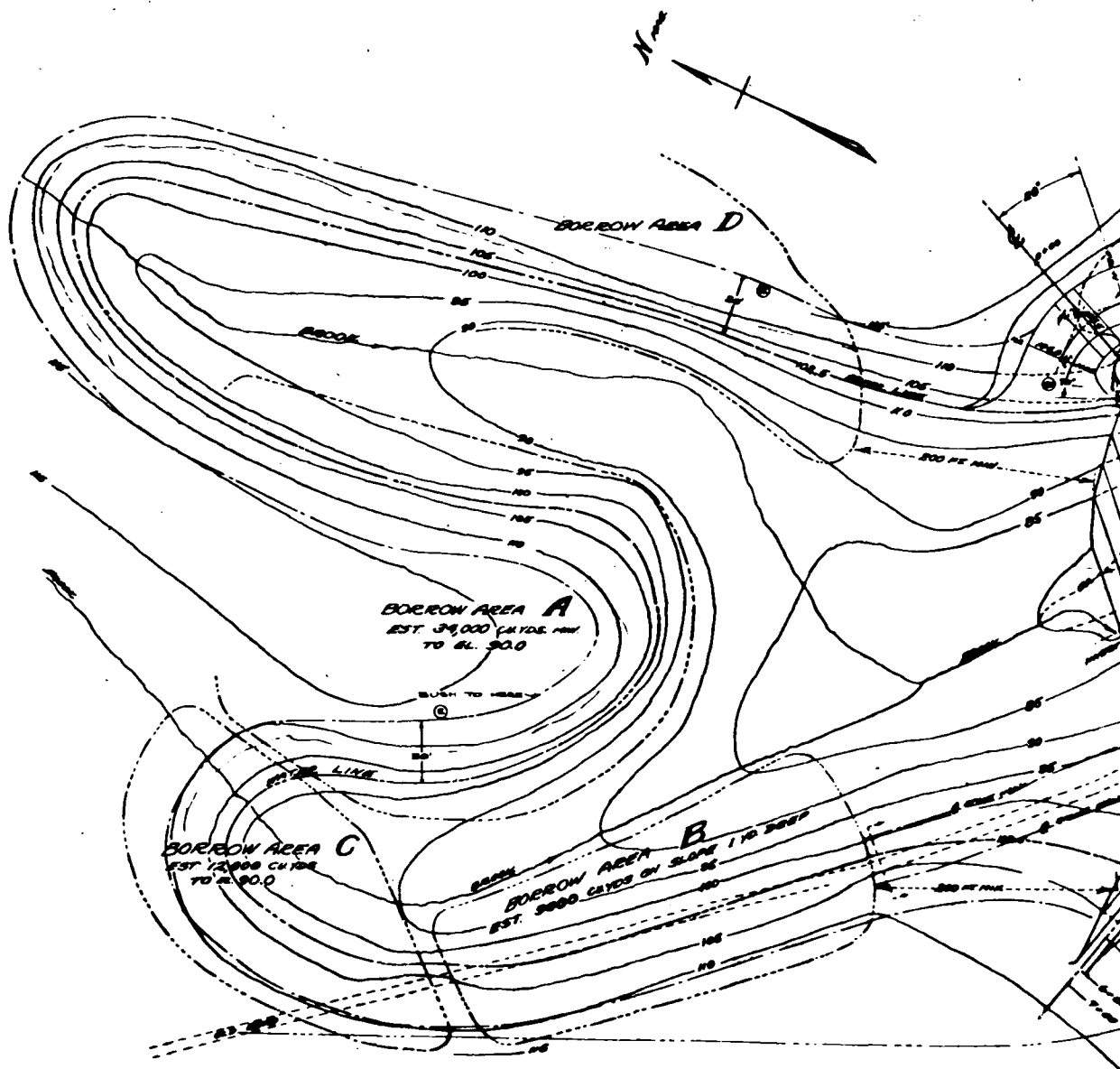


APPROVED  
BY 11 102  
DATE 11 102

NOT TO SCALE

1	DESIGNER'S ADDRESS	11	DATE
2	OWNER'S NAME	12	BY
3	PROJECT NAME	13	DATE
4	THREAT NAME	14	BY
5	THREAT NAME	15	DATE
6	THREAT NAME	16	BY
7	THREAT NAME	17	DATE
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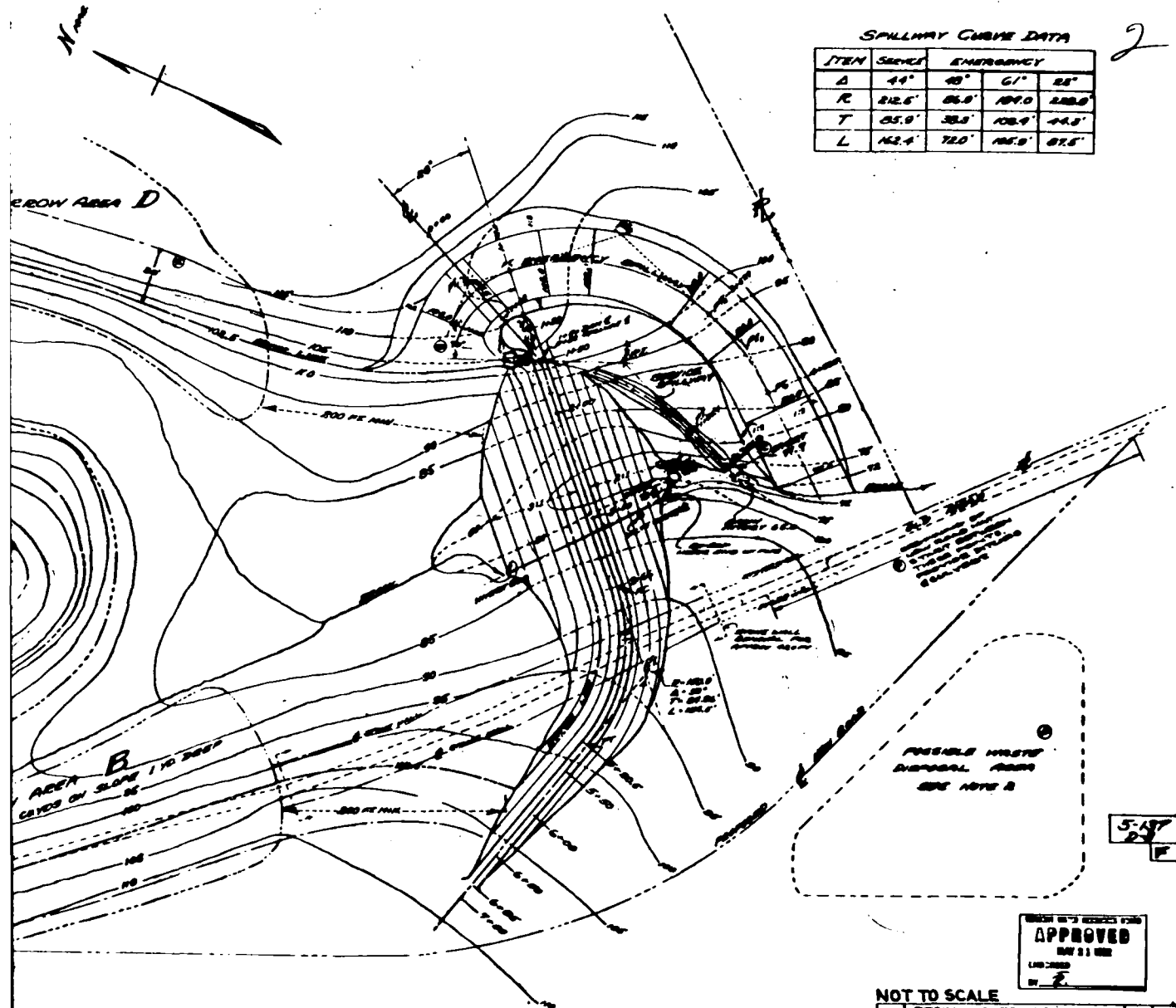
• **NOTES:**

1. AREAS TO BE TERRAILED AND SEEDED
2. EMERGENCY SPILLWAY
3. DAM EMERGENCY SPILLWAY
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# SPILLWAY CURVE DATA

ITEM	SEWER	EMERGENCY			
A	44"	40"	61"	28"	
R	212.5'	25.9'	109.0'	228.8'	
T	25.9'	38.3'	108.4'	44.8'	
L	162.4'	72.0'	165.9'	87.6'	

2



5-177  
237  
F

APPROVED  
MAY 11 1961  
LAWRENCE  
BY 2

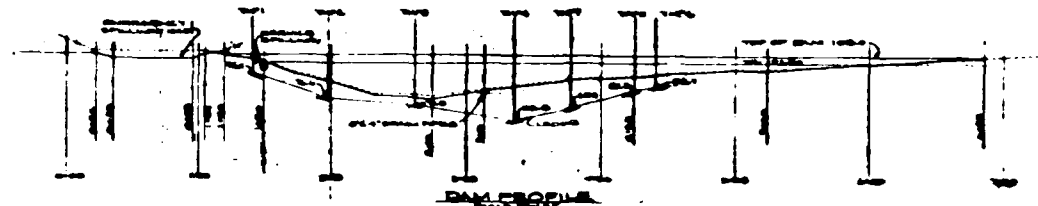
## NOTES

1. AREAS TO BE TERRAZZED AND SEEDED
- A. EMERGENCY SPILLWAY
- B. DAM EMBANKMENT EXCEPT UPSTREAM
- C. AREA BELOW WATERLINE
- D. SEWER SPILLWAY CONDUIT COVER
2. WASTE DISPOSAL AREA NOT MORE THAN 200 FE FROM DAM SITE TO BE DESIGNATED BY ENGINEER

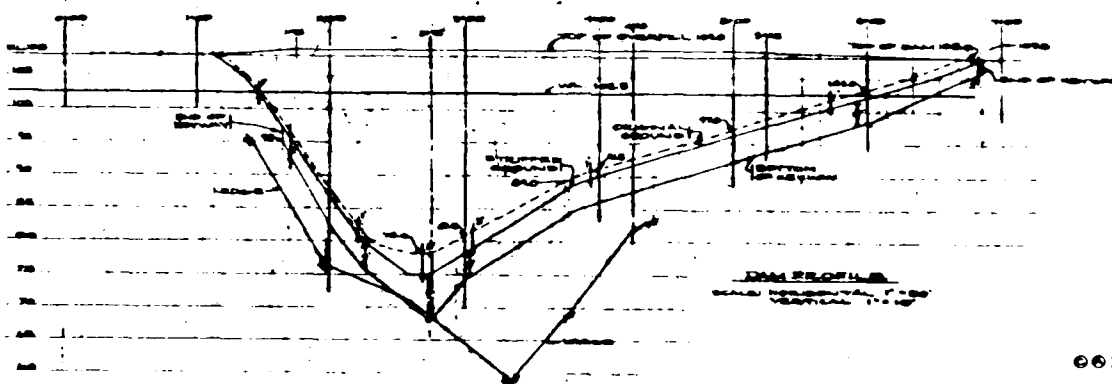
## NOT TO SCALE

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B	SEWERAGE SYSTEMS OF NEW YORK	1
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E	SEWERAGE SYSTEMS OF NEW YORK	1
F	SEWERAGE SYSTEMS OF NEW YORK	1
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W	SEWERAGE SYSTEMS OF NEW YORK	1
X	SEWERAGE SYSTEMS OF NEW YORK	1
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Z	SEWERAGE SYSTEMS OF NEW YORK	1

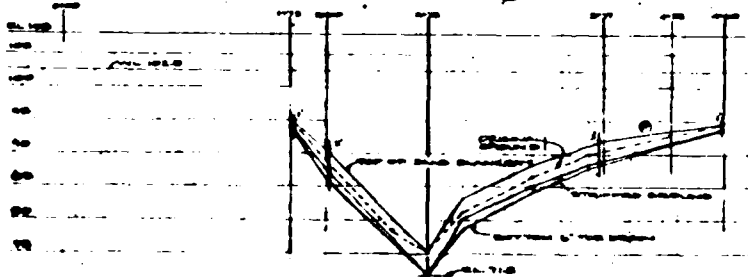




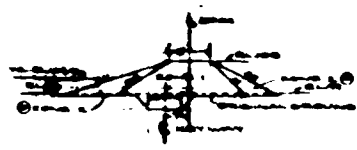
DAM PROFILE



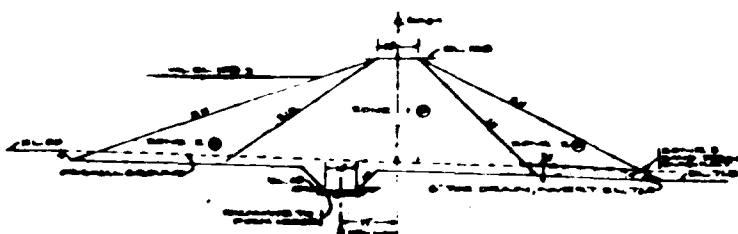
DAM PROFILE



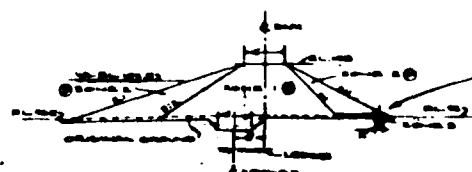
DAM PROFILE



DAM PROFILE



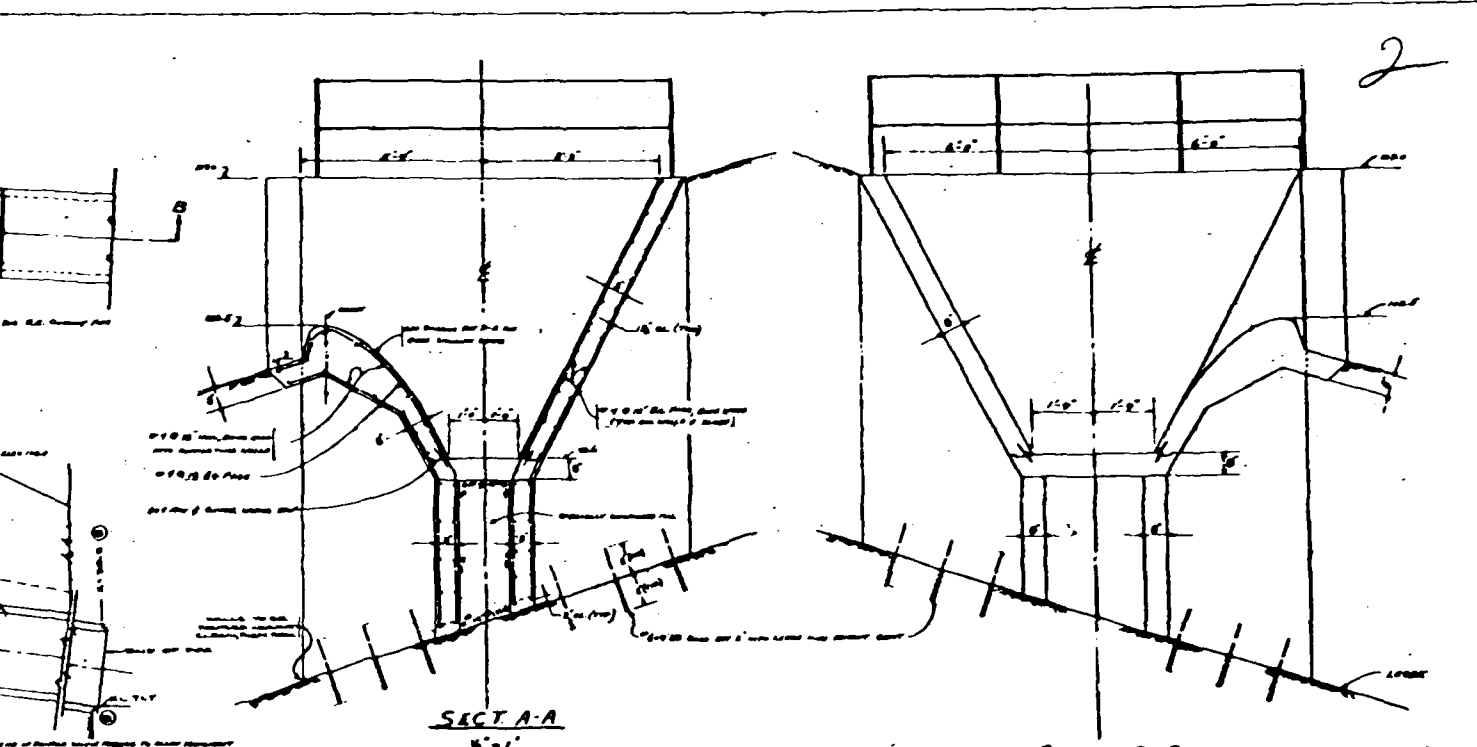
DAM PROFILE



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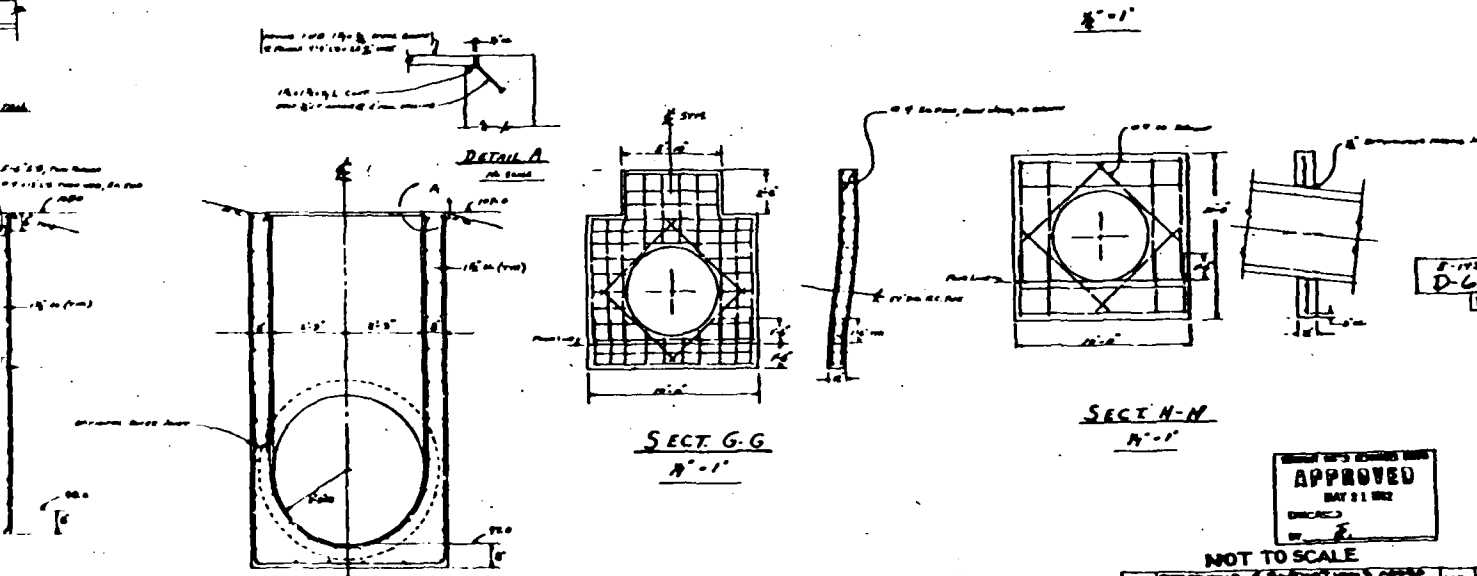






SECT. A-A  
2'-1'

SECT. C-C (See drawing and see Sect. A-A)  
 $\frac{1}{2} = 1'$



Detail A  
no sound

SECT. G.G  
N° - 1°

SECTION-N  
N-1

5-143  
D-6

APPROVED  
MAY 21 1962

**NOT TO SCALE**

## NOTES

[illegible][illegible]

APPENDIX C  
DETAIL PHOTOGRAPHS

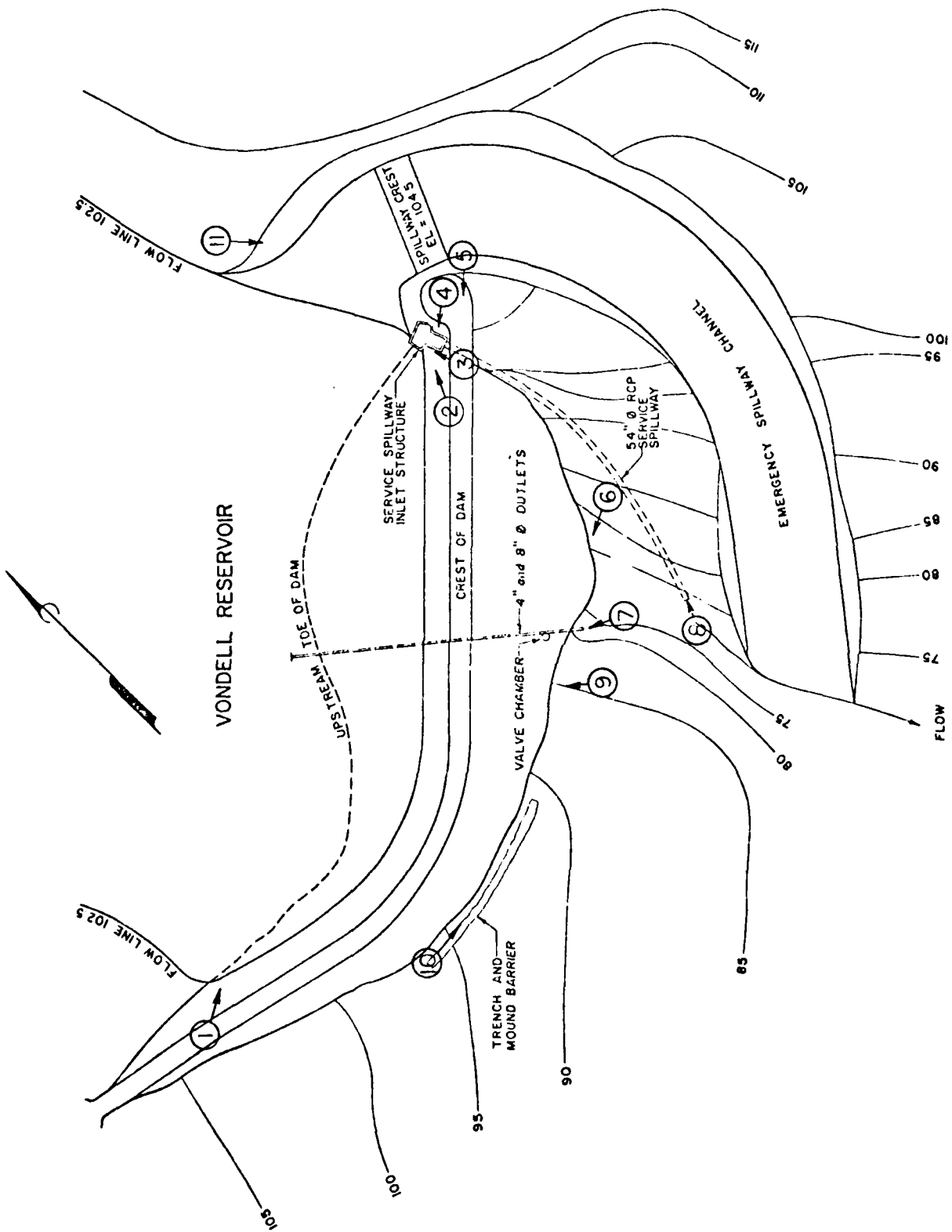
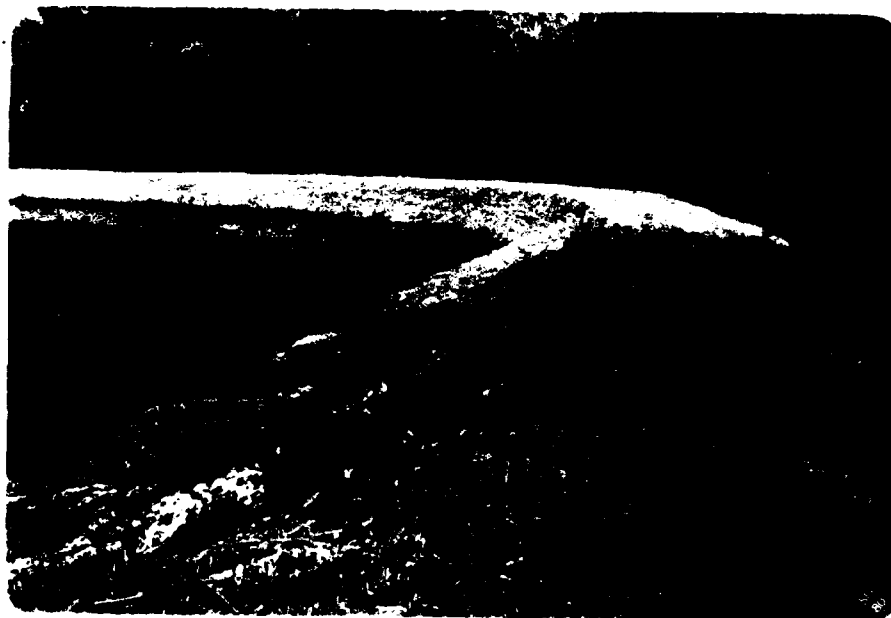


PHOTO LOCATION PLAN  
VONDELL RESERVOIR DAM



(1) Crest and Upstream Slope, From Right Abutment



(2) Service Spillway Inlet Structure

U.S. ARMY ENGINEER DIV, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	Vondell Reservoir Dam
JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE		VT 00160
		Woodstock, Vermont
		August 5, 1980
		C-2



(3) Top of Service Spillway Inlet Wall,  
Showing Deteriorated Concrete



(4) Depression in Backfill Adjacent to Left Wall of Service Spillway Inlet

U.S. ARMY ENGINEER DIV. NEW ENGLAND  
CORPS OF ENGINEERS  
WALTHAM, MASSACHUSETTS

JAMES W. SEWALL COMPANY  
CONSULTANTS  
OLD TOWN, MAINE

NATIONAL PROGRAM OF  
INSPECTION OF  
NON-FED. DAMS

Vondell Reservoir Dam  
VT 00160

Woodstock, Vermont  
August 5, 1980

C-3

Subject Impoundment of water for dam

Computation for 100 ft. dam

Job No. 953-0511

7

Computed by WEP

Checked by SDM

Date 9-23-00

2) Peak Flood and Stage in D/S Stream Reach to

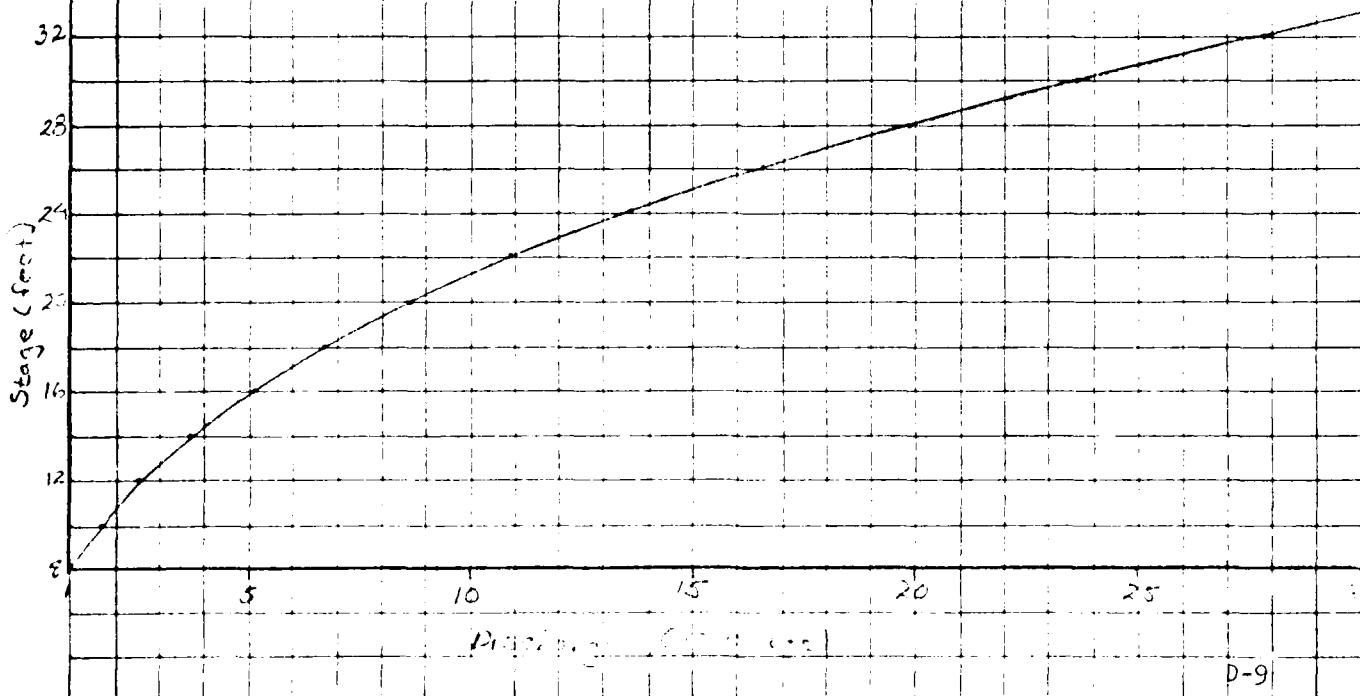
a) Typical Cross-section - first 2000 feet D/S of dam

$$V = 1.485 R^{2/3} S^{1/2} \quad C = 0.10$$

$$S = 0.034$$

$$K = 64$$

H	A	P	R	V	Q	H	A	P	R	V	Q
2	18	13.1	1.35	3.37	61	22	100	15.2	1.43	12.7	2640
4	42	24.2	2.35	4.44	1233	24	150	12.33	1.33	12.3	3240
6	90	37.2	3.25	5.52	2472	26	200	10.4	1.23	11.8	3720
8	149	52.1	4.13	6.66	4016	28	250	8.5	1.13	11.3	4180
10	210	68.8	4.99	7.87	5871	30	300	6.7	1.03	10.8	4620
12	289	87.1	5.85	9.14	8041	32	350	5.0	0.93	10.3	5040
14	378	106.9	6.69	10.47	10528	34	400	3.4	0.83	9.8	5440
16	480	129.1	7.54	11.87	13456						
18	594	153.7	8.38	13.30	16719						
20	720	180.7	9.22	14.77	21373						



D-9

Subject Inspection of multi-arch dam

Computation Vol. 1 of 1 Job No. 953-051

Computed by MEB Checked by SDM Date 9-22-80

## Downstream Failure Scenarios

### 1. Peak Failure Outflow

#### a) Breach Outflow

##### 1) Breach width

$$\text{Mid-Breach } W_b = 108 - 33\frac{1}{2} = 74.5$$

Approx. full height  $h_d = 230$  feet (from crest to toe)

Breach  $W_b$  (See BREACH DAM FAILURE GUIDELINES)

$$W_b = 0.4 \times 230 = 92 \text{ feet}$$

##### 2) Breach outflow

$$Q_b = 1.487 W_b \sqrt{h_d^3}$$

Assume full height to top of dam

$$h_d = 230 \text{ feet}$$

$$W_b = 92 \text{ feet}$$

$$Q_b = 29300 \text{ cfs}$$

### b) Breaching Spillway Discharge

Assume failure does not include primary or secondary spillway

Assume full height to top of dam

### 2. Peak Flood Outflow ( $Q_p$ )

$$Q_p = Q_b + Q_{sp} = 29300 + 1400 \text{ cfs} = 30700 \text{ cfs}$$

Subject Inspection of Pond at ...

Computation Vendell R. ...

Job No. 953-15N

Computed by MEB

Checked by SDM/GW

Date 7-22-80

2) Peak Outflow ( $Q_{P2}$ )

Using FED-ACK Guidelines "Surcharge Storage Rating  
Alternate Method":

$$Q_{P2} = 320 \text{ cfs} \quad H = 3.2 \text{ feet} \quad Q_{P1} = 100 \text{ yr flood}$$

f) Spillway capacity to outflow

$$Q_{SH} = 1400 \text{ cfs}$$

Spillway capacity is 438 % of the outflow @ 100 yr flood

5) Summary

a) Peak Inflow

Test flood @ 100 yr flood  $Q_{P1} = 385 \text{ cfs}$

b) Peak Outflow

$Q_{P2} = 320 \text{ cfs}$  @ 100 yr flood

c) Spillway max capacity

$$Q_{SH} = 1400 \text{ cfs}$$

At Test Flood = 100 yr flood, the spillways handle the entire flow utilizing less than 23 % of their capacity with an average surcharge over the service spillway crest of 3.2 feet.

Subject Inspection of non-federal dams

Computation Vendell Reservoir

Job No. 153-05 N

Computed by MEB

Checked by SDM/BW

Date 9-22-80

c) Spillway capacity to top of dam el. 108

$$H = 5.5' \quad Q_{sp} = 1400 \text{ cfs}$$

d) Surge height to pass  $Q_{sp}$

$$Q_{sp} = 385 \text{ cfs} \quad H = 3.35 \text{ feet over service spillway}$$

A) Effect of Surge on Max Probable Discharges

a) Lake area varies with surge

see curve p. 2 - surge volume = storage - 73 acre-feet

b) Assume normal pool level at spillway crest el 102.5

c) Watershed area = 0.65 mi<sup>2</sup>

d) Discharge ( $Q_{p2}$ ) at various surge elevations

$$H = 5' \text{ (el 107.5)} \quad V = 105 - 73 = 32 \text{ acre-feet}$$

$$S = 32 / (.65)(3.2) = 1.21''$$

$$H = 2.5' \text{ (el 105.0)} \quad V = 91 - 73 = 18 \text{ acre-feet}$$

$$S = 18 / (.65)(3.2) = .52''$$

From Approximate Storage Routing Guidelines

(19" max flood in N.E. in New England)

$$Q_{p2} = Q_{p1} \left( 1 - \frac{S}{3.2} \right) \approx 15 \text{ ft E } Q_{p1} = 385 \text{ cfs}$$

$$\text{For } H = 5' \quad Q_{p2} = 280 \text{ cfs}$$

$$H = 2.5' \quad Q_{p2} = 330 \text{ cfs}$$

Subject Inspection of non-federal dam

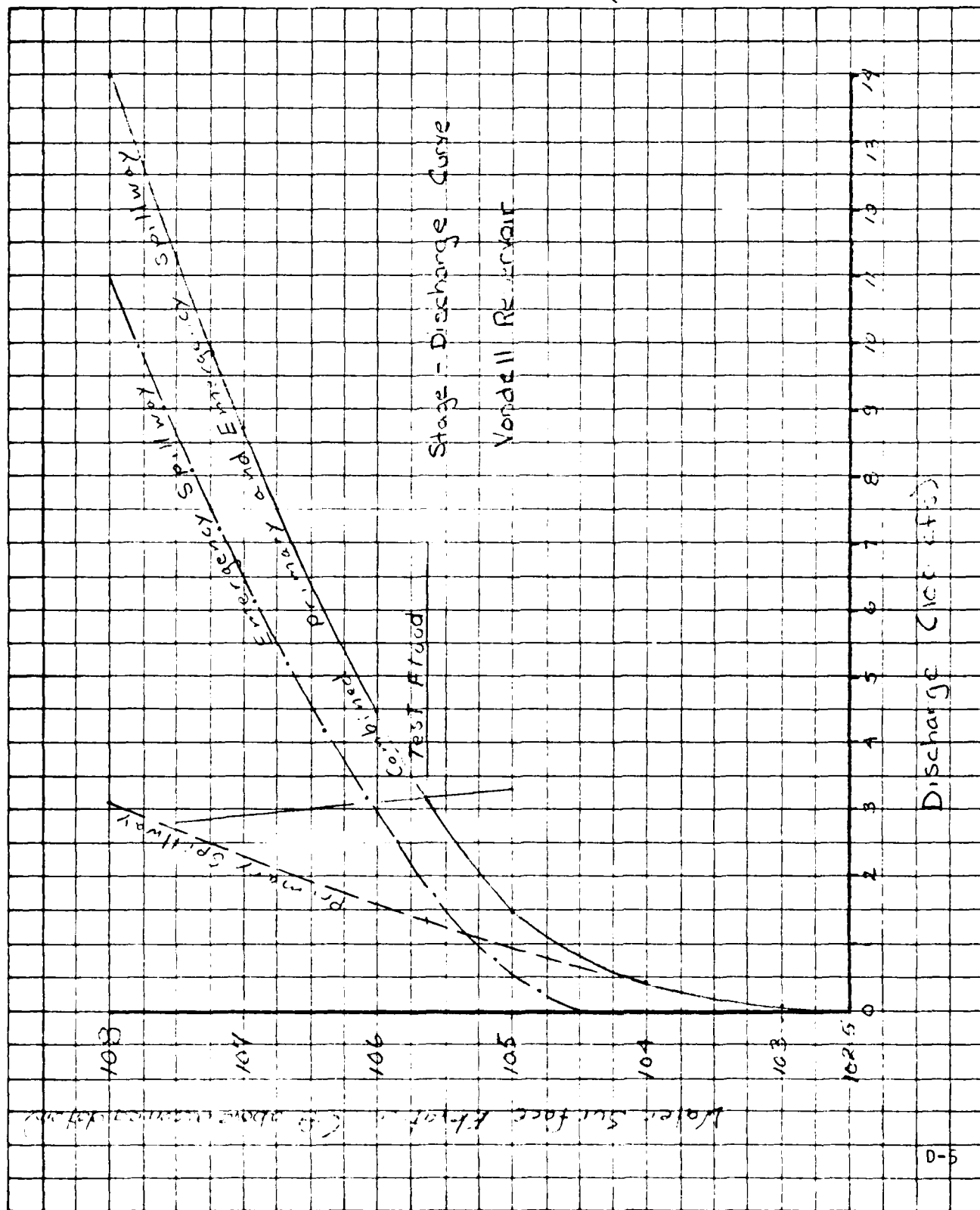
Computation Vondell Reservoir

Job No. 953-C51

Computed by MEP

Checked by SDM/BW

Date 9-19-80



Subject Inspection of main tank, etc.

Computation Hydro. Engineer Job No. 953-SSA

Computed by L.F.H. Checked by SDM/BW Date 9-17-50

b) Test Flood = 100 yr. flood  $\therefore Q_p = 385 \text{ cfs}$

3) Spillways at Pond T-1

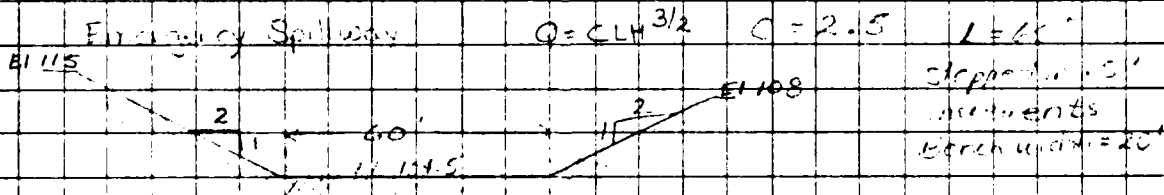
a) Peak Inflow  $Q_p = 385 \text{ cfs}$

b) Outflow Rating Curve

Primary Spillway - concrete spillway (crest el. 102.5)  
discharging to a 54"  $\phi$  RCP.  
7' spillway section controls flow.

$$Q = CLH^{3/2} \quad L = 7 \quad C = 3.4$$

H	Q	WS El.	H	Q	WS El.
.5	8	103.0	3.5	227	107.0
1.5	14	104.0	4.5	307	108.0
2.5	34	105.0	6.5	394	109.0
3.5	156	106.0	7.5	480	110.0



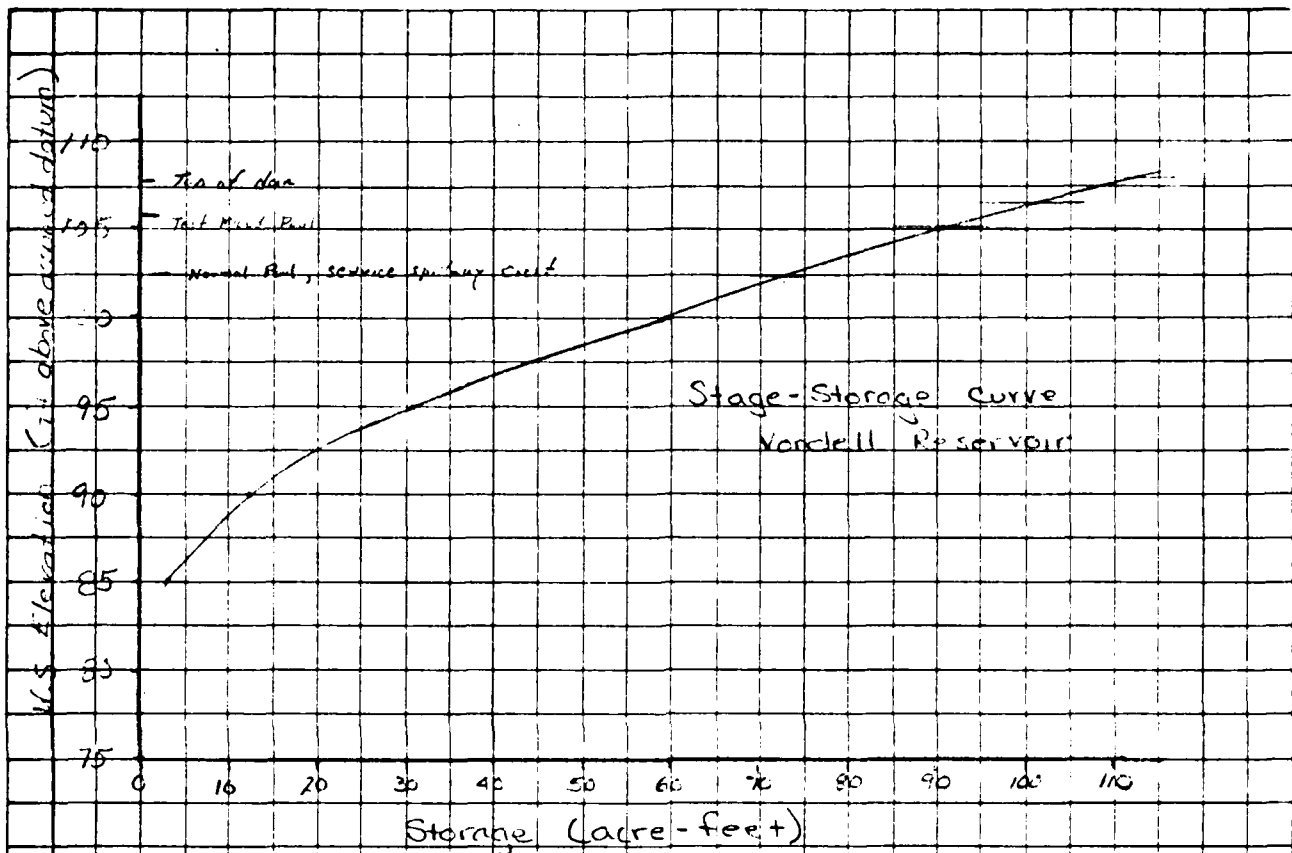
H	Q	WS El.
.5	55	105.0
1.5	292	106.0
2.5	643	107.0
3.5	1091	108.0

Outflow Conduits (normally closed) - 80' long, 20' diam. head to  
top of dam. Use Hazen-Williams formula  $f = .2083 \left( \frac{100}{C} \right)^{1.85} \frac{L}{D^{4.87}}$   
 $C = 120, f = .25/100'$   
 $Q_p = 9 \text{ cfs} \quad Q_y = 1 \text{ cfs}$

Subject Inspection of non-federal dam

Computation Vendell Reservoir Woodstock, VT Job No. 953-05N

Computed by MEB Checked by SM Date 9-19-80



Stage-Storage curve computed from contour areas on drawing # 5-137 D-3, "General Arrangement", Grout Engineering Company.

#### ii) Hazard Potential

Failure flows would cause further damage to three light duty rockhops previously overtopped by pre-failure flows. The failure flows would also overtop and probably fail Cox Reservoir Dam about 1000' D.F. According to a previous Phase I Rep't, Cox Dam has potential to flood two residences near failure, with the potential loss of a few lives. These residences would be flooded by the Vendell breach flows regardless of failure of Cox.

#### iii) Classification

Size is: Small

Hazard is: Significant

D-3

Subject Trigonometry of non-ferrous dams

Computation Vandell Reservoir, Woodstock, Vt. Job No. 953-05 N

Computed by D E B Checked by SDM / BW Date 9-15-93

## Hydrologic / Hydraulic Inspection

### Performance on Test Flood Conditions

#### 1. Maximum Peak Flood

a) Watershed classified as "Mountainous"

b) Watershed Area

0.65 sq. miles - planimeter from USGS sheet  
JWS average of 3 trials

0.54 sq. miles - Vt Dept of Water Resources Information

c) From NED-ACE "Preliminary Guidance for Estimating  
Max. Probable Discharges" - Guide Curve For PMF -  
Peak Flow Rates:

PMF  $\approx$  2950 cfs / square mile

d) Peak Inflow

$$Q_p = (2950 \text{ cfs/mi}^2)(0.65 \text{ mi}^2) \approx 1920 \text{ cfs @ PMF}$$

Similarly @  $1/2$  PMF  $Q_p' \approx 960$  cfs

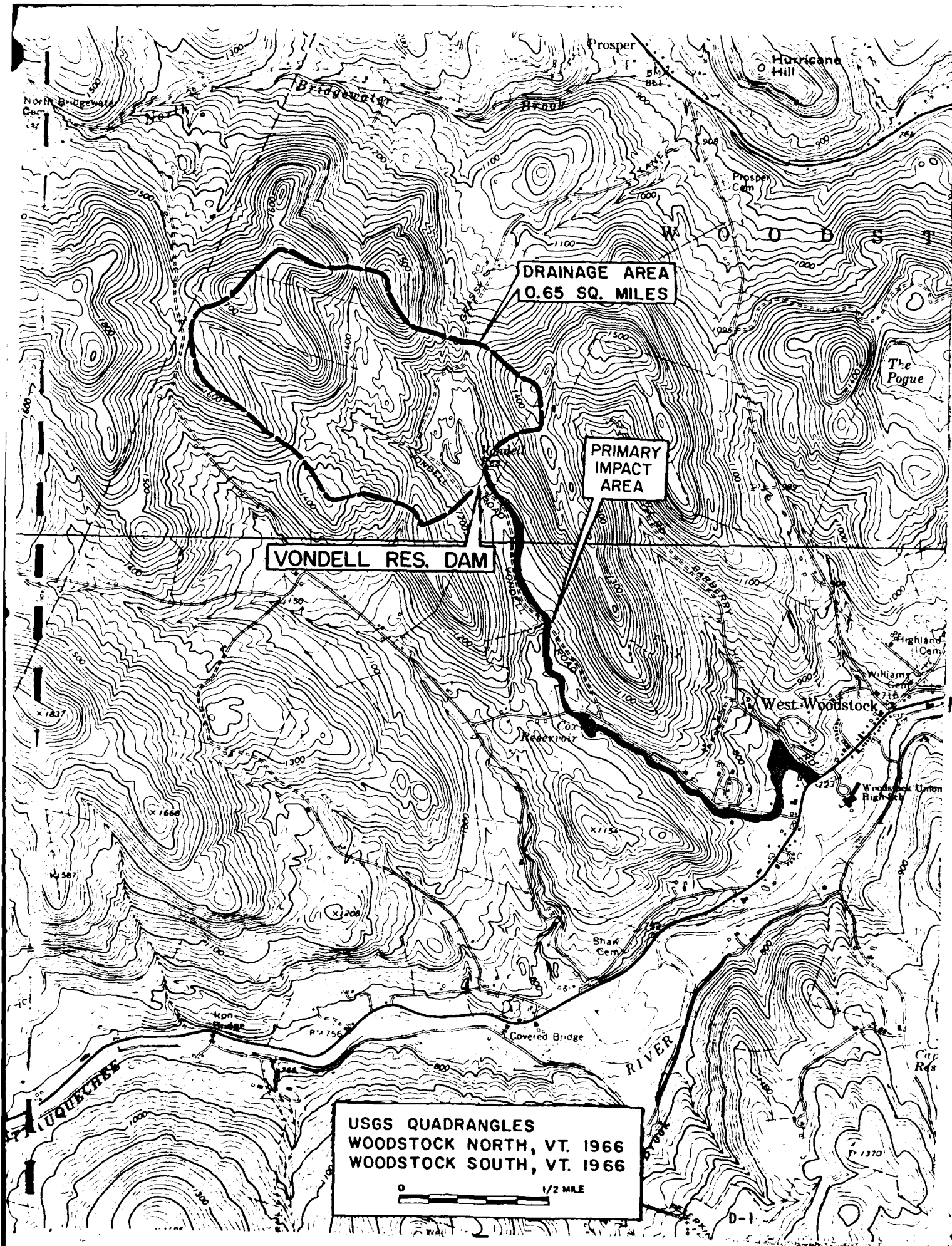
100 yr Flood  $\approx 1/5$  PMF = 385 cfs

U.S. Dept of  
Commerce Tech  
Paper #40  
p. 58

#### 2. Test Flood

a) Classification of Dam According to  
NED-ACE Recommended Guidelines

i) Size: Storage Volume = 114 acre-feet  
Height = 33 feet (108-75)



DRAINAGE AREA  
0.65 SQ. MILES

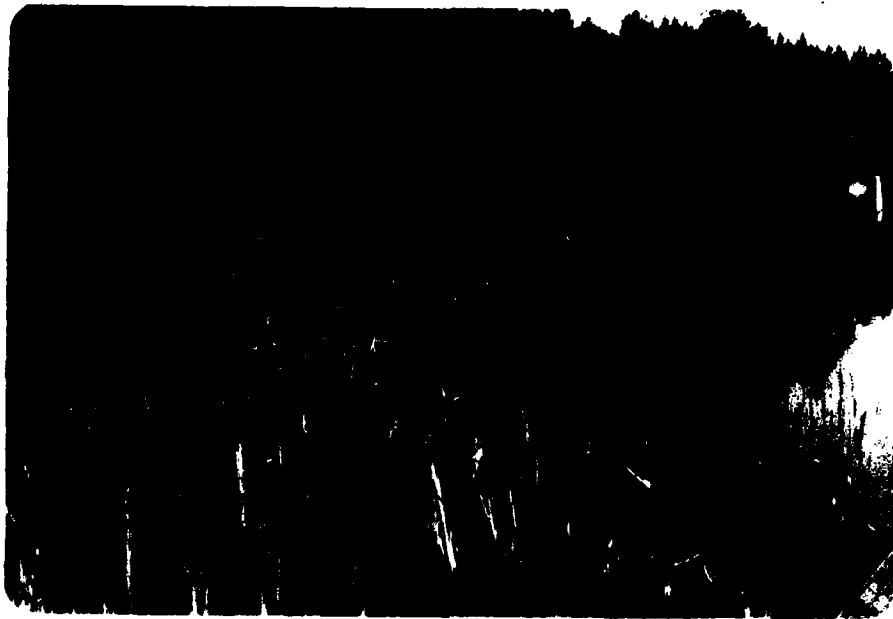
PRIMARY  
IMPACT  
AREA

VONDELL RES. DAM

USGS QUADRANGLES  
WOODSTOCK NORTH, VT. 1966  
WOODSTOCK SOUTH, VT. 1966

0 1/2 MILE

APPENDIX D  
HYDRAULIC/HYDROLOGIC COMPUTATIONS



(11) Emergency Spillway Inlet Channel; Service Spillway in  
Right Background

U.S. ARMY ENGINEER DIV, NEW ENGLAND  
CORPS OF ENGINEERS  
WALTHAM, MASSACHUSETTS

JAMES W. SEWALL COMPANY  
CONSULTANTS  
OLD TOWN, MAINE

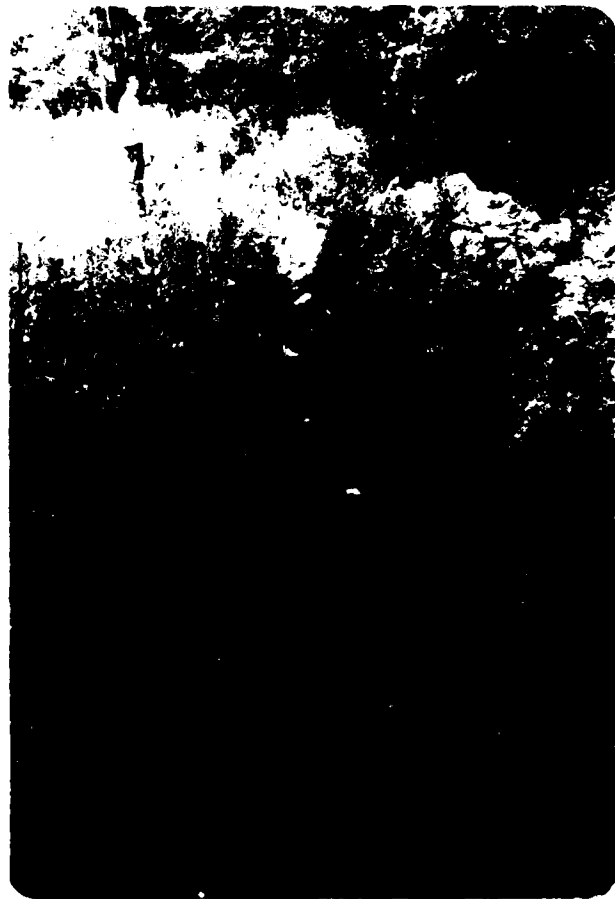
NATIONAL PROGRAM OF  
INSPECTION OF  
NON-FED. DAMS

Vondell Reservoir Dam  
VT 00160  
Woodstock, Vermont  
August 5, 1980

C-7



(9) 6" CMP Toe Drain Outlet



(10) Trench Excavated at Downstream  
Toe of Dam

U.S. ARMY ENGINEER DIV. NEW ENGLAND  
CORPS OF ENGINEERS  
WALTHAM, MASSACHUSETTS

JAMES W. SEWALL COMPANY  
CONSULTANTS  
OLD TOWN, MAINE

NATIONAL PROGRAM OF  
INSPECTION OF  
NON-FED. DAMS

Vondell Reservoir Dam  
VT 00160

Woodstock, Vermont

August 5, 1980

C-6



(7) 4" and 8" Diameter Outlet Pipes at Toe of Dam



(8) 54" Diameter Service Spillway Outlet Pipe

U.S. ARMY ENGINEER DIV, NEW ENGLAND  
CORPS OF ENGINEERS  
WALTHAM, MASSACHUSETTS

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OLD TOWN, MAINE

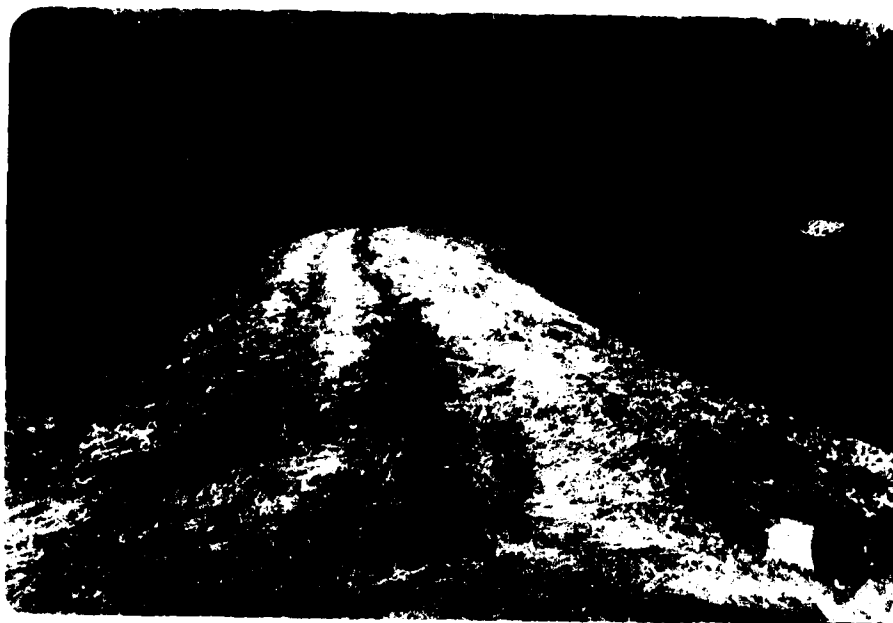
NATIONAL PROGRAM OF  
INSPECTION OF  
NON-FED. DAMS

Vondell Reservoir Dam  
VT 00160

Woodstock, Vermont

August 5, 1980

C-5



(5) Crest of Dam from Left Abutment



(6) Valve Chamber and Valve Boxes on Downstream Slope of Dam

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WALTHAM, MASSACHUSETTS

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NATIONAL PROGRAM OF  
INSPECTION OF  
NON-FED. DAMS

Vondell Reservoir Dam  
VT 00160

Woodstock, Vermont

August 5, 1980

C-4

Subject Inspection of 15" - 24" dams

Computation Vandell Dam

Job No. 952-1-11

Computed by MFP

Checked by SDM

Date 7-23-11

a) Storage at 15" - 24" dam

Reference storage at 15" - 24" dam = 1.4 Ac-ft

i) Pre-flood stage in 1921 (typical)

$$Q_{p1} = 1400 \text{ cfs} \quad V = 192.45 \text{ cu ft} \quad F = 13.2 \text{ Ac-ft}$$

ii) Flood stage

$$Q_{p1} = 20,000 \text{ cfs} \quad V = 192.45 \text{ cu ft} \quad F = 126.75 \text{ Ac-ft}$$

iii) A value of storage  $V_1 = 185 \text{ cu ft} = 113.5 \text{ Ac-ft}$

$$Q_{p2} (\text{TRIAL}) = Q_{p1} (1 - V_1/V_2) \quad V_1 > 8/2 \text{ cu ft}$$

$$= 20,000 (1 - 185/192.45)$$

$$= 15,400 \text{ cfs} \quad (3 \text{ 150" dia})$$

$$V_2 = 76.75 \text{ cu ft} \quad 1/2 = 31.5 \text{ Ac-ft}$$

$$Q_{p2} = Q_{p1} (1 - V_1/V_2)$$

$$= 20,000 (1 - 185/192.45)$$

$$= 18,500 \text{ cfs} \quad (3 \text{ 150" dia})$$

$$Q_{p2} (\text{TRIAL}) = Q_{p1} (1 - V_1/V_2)$$

$$= 10,500 (1 - 185/192.45)$$

$$= 12,500 \text{ cfs}$$

$$V_1 = 22.45 - 13.75/2 = 3.2$$

$$V_2 = 16.75 - 13.75/2 = 2.25$$

$$Q_{p2} = Q_{p1} (1 - V_1/V_2)$$

$$= 18,500 (1 - 3.2/2.25)$$

$$= 13,500 \text{ cfs}$$

$$Q_{p2} = 13,500 \text{ cfs} \quad 3 \text{ 150" dia}$$

at Vandell Road crossing

See plan p. 10

Pre-flood stage of Vandell Road = 2 ft above roadway

Flood stage = 6.5 ft

Base in 1921 = 6.5 feet at Vandell Road

Subject Design of proposed dam

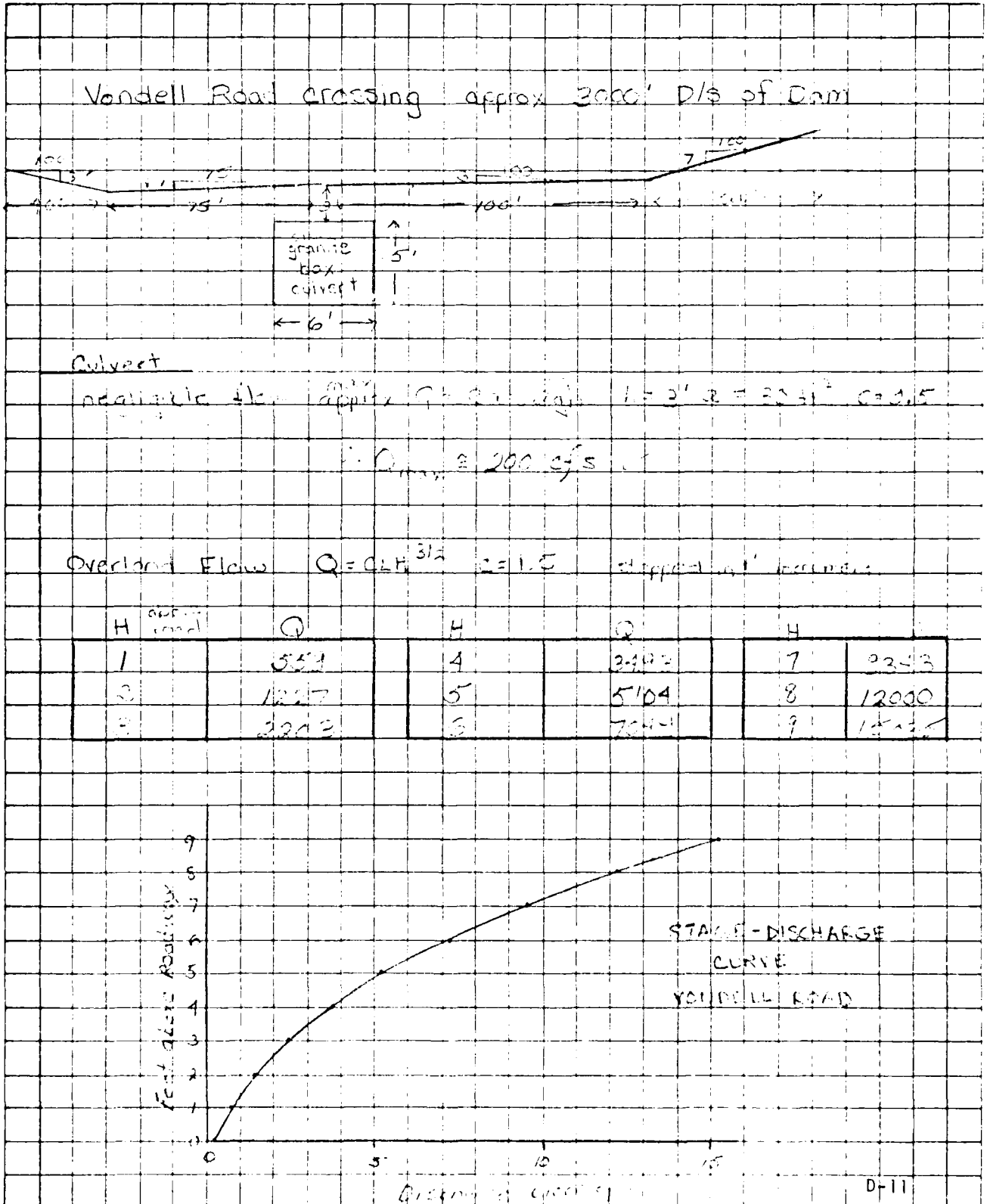
Computation Vondell Reservoir

Job No. 953-05 N

Computed by H.F.

Checked by SDM

Date 9.23.1911



Subject Inspection of non-federal ditches

Computation Landell B. Brown

Job No. 953-05N

Computed by SDH

Checked by M.E.B.

Date 9/26/80

a) Stream near Landell B. Brown L.I. 2.1

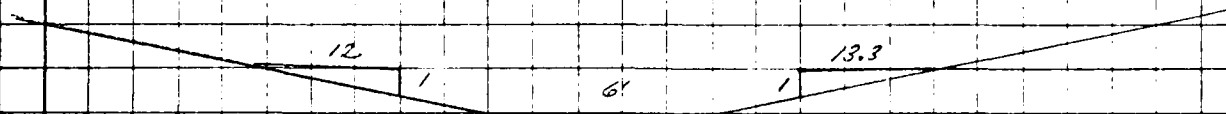
Typical Section:

$$V = 1.486 R^{2/3} S^{1/2}$$

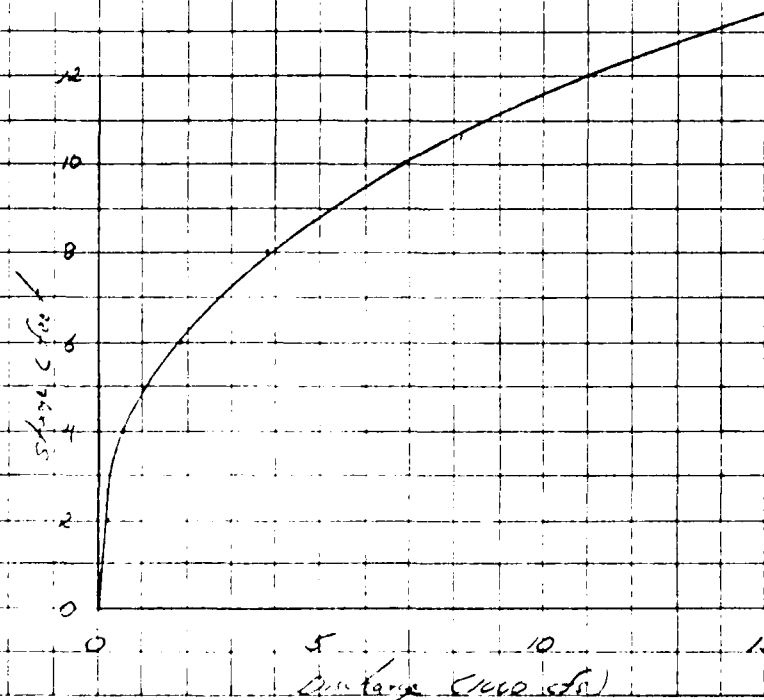
$$S = .014 \text{ (USGS)}$$

$$Q = AV$$

$n = .1$  (vegetated banks)



H	A	P	R	V	Q	H	A	P	R	V	Q
2	62.6	56.8	1.10	1.88	117.5	12	1894	341	6.10	5.90	11,180
4	226.4	107.5	2.11	2.90	656	14	2563	361	7.09	6.5	16,751
6	491	158	3.10	3.76	1846						
8	855	209	4.10	4.53	3883						
10	1325	260	5.1	5.2	6940						



Subject Inspection of non-federal dams

Computation Kendall Reservoir

Job No. 953-05 N

Computed by SDM

Checked by YEB

Date 9/26/80

d) Storage Routing - Stream Reach 3000-4500' D/S of Dam

Reservoir Storage at line of failure  $S = 114 \text{ A.-FT.}$

1) Pre-failure storage in reach (typical section p. 11)

$$Q_{PR} = 1400 \text{ cfs} \quad V = \frac{401 \text{ FT}^2 \times 1500'}{43,500} = 13.8 \text{ A.-FT.}$$

2) Failure Storage

$$Q_{PR} = 13,500 \quad V = \frac{2182 \text{ FT}^2 \times 1500}{43,500} = 75.1 \text{ A.-FT.}$$

3) Available storage in reach  $V_1 = 75.1 - 13.8 = 61.3 \text{ A.-FT.}$

$V_1 > \frac{S}{2} \therefore \text{cut reach in half}$

$$Q_{PR} (\text{Trial 1}) = Q_{PR} \left(1 - \frac{V_1}{S}\right) = 13,500 \left(1 - \frac{30.7}{114}\right) = 9864 \text{ cfs (at 3750' D/S)}$$

$$3000-3750' \text{ D/S} \quad V_2 = 30 - 13.8 = 23.1$$

$$Q_{PR} = Q_{PR} \left(1 - \frac{V_2}{S}\right) = 13,500 \left(1 - \frac{23.1 + 30.7/2}{114}\right) = 10,314 \text{ cfs @ 3750' D/S}$$

$$Q_{PR} (\text{Trial 1}) = Q_{PR} \left(1 - \frac{V_1}{S}\right) \quad V_1 = \frac{62 \times 10,314}{2} = 24.1$$

$$= 10,314 \left(1 - \frac{24.1}{114}\right) = 8134 \text{ cfs}$$

$$3750-4500' \text{ D/S} \quad V_2 = \frac{52.1 - 13.8}{2} = 19.2$$

$$Q_{PR} = Q_{PR} \left(\frac{V_{\text{ave}}}{S}\right) = 10,750 \left(1 - \frac{19.2 + 24.1}{114}\right) = 8350 \text{ cfs @ 4500' D/S of Dam}$$

Subject Inspection of non-ferrous dams

Computation Kenilworth Reservoir

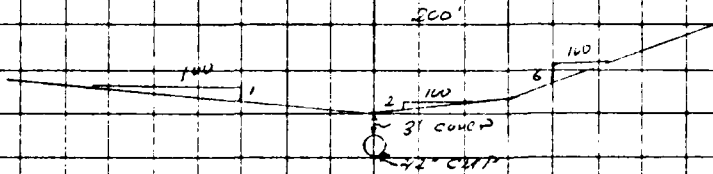
Job No. 953-05 N

Computed by SDT

Checked by MEB

Date 9/26/80

From Road Crossing 450' E of Dam



From Handbook of Steel Drainage & Highway Construction Products  
p. 110, culvert capacity = 40 cfs

$$Q = CAH^{3/2} \quad C = 2.5$$

Flow over road

H	Q	H	Q
2	-	2.2	910 cfs
4	7 cfs	2.4	1100 "
6	26 "	2.6	1317 "
8	61 "	2.8	1562 "
10	114 "	3	1835 "
12	189 "	4	3668 "
14	288 "	5	6364 "
16	412 "	6	10,028 "
18	564 "		
20	745 "		

Subject Inspection of non-federal dams

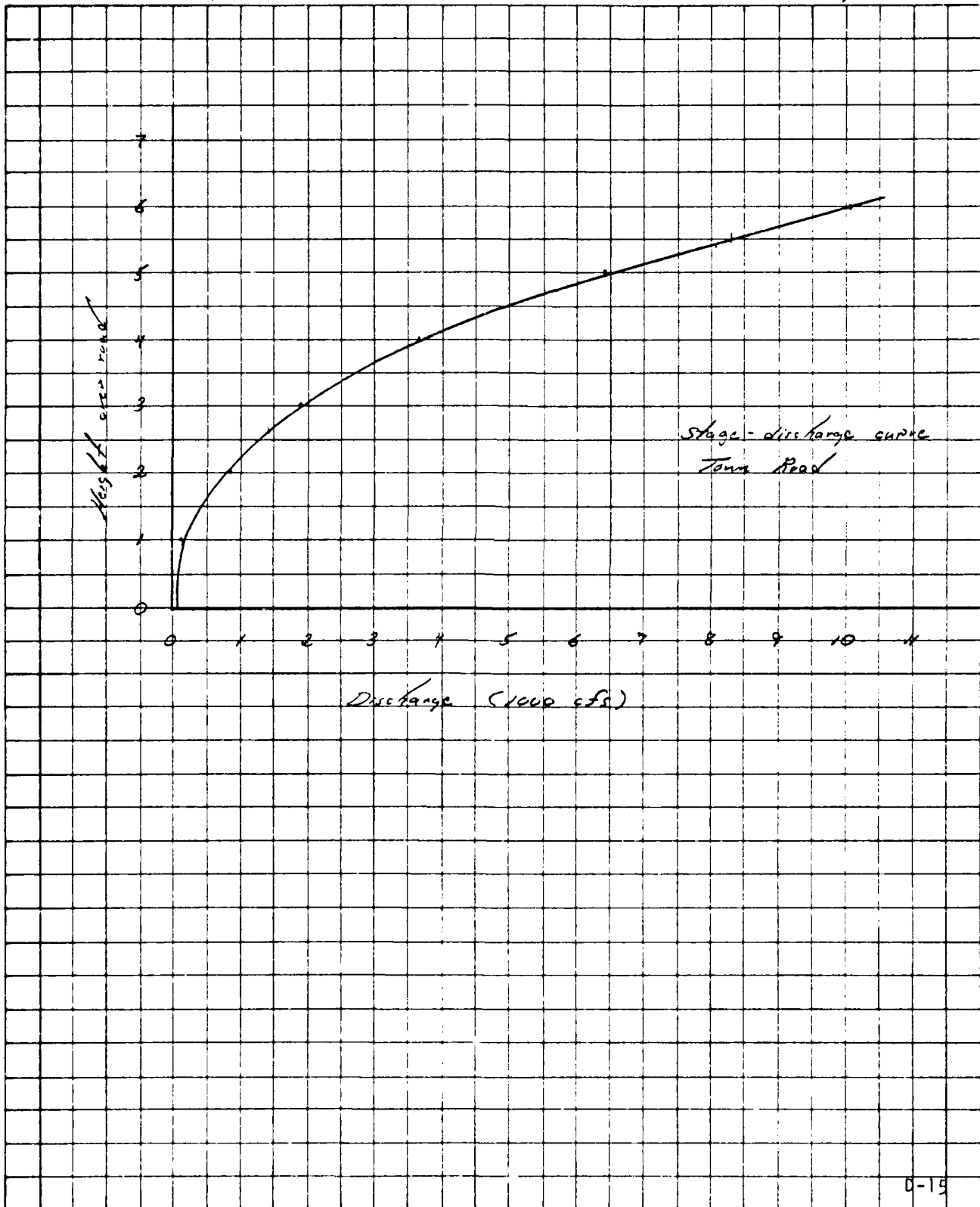
Computation Vondell Reservoir

Job No. 953-05 N

Computed by SDH

Checked by MEB

Date 9/29/00



Subject Inspection of new Federal dam

Computation Venue II Reservoir

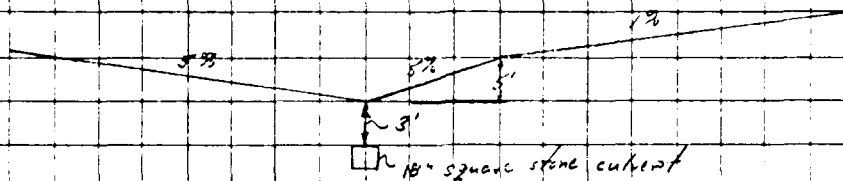
Job No. 953-05 N

Computed by SDM

Checked by MJB

Date 9/29/80

Drainage grading 4000' ± from dam



Outlet

Roughly estimate flow using orifice equation

$$Q = CA \sqrt{2gh} \quad h = 3', A = 3.25 ft^2, C = .5$$

$$Q = 15.6 cfs$$

Pool

$$Q = CLH^{3/2} \quad C = 2.5$$

H	Q		H	Q	
.2	—	cfs	3	572	cfs
.4	2	"	4	1200	"
.6	7	"	5	2127	"
.8	16	"	6	3894	"
1	30	"	7	10,255	"
2	189	"	8	16,797	"

Subject Inspection of non-federal dams

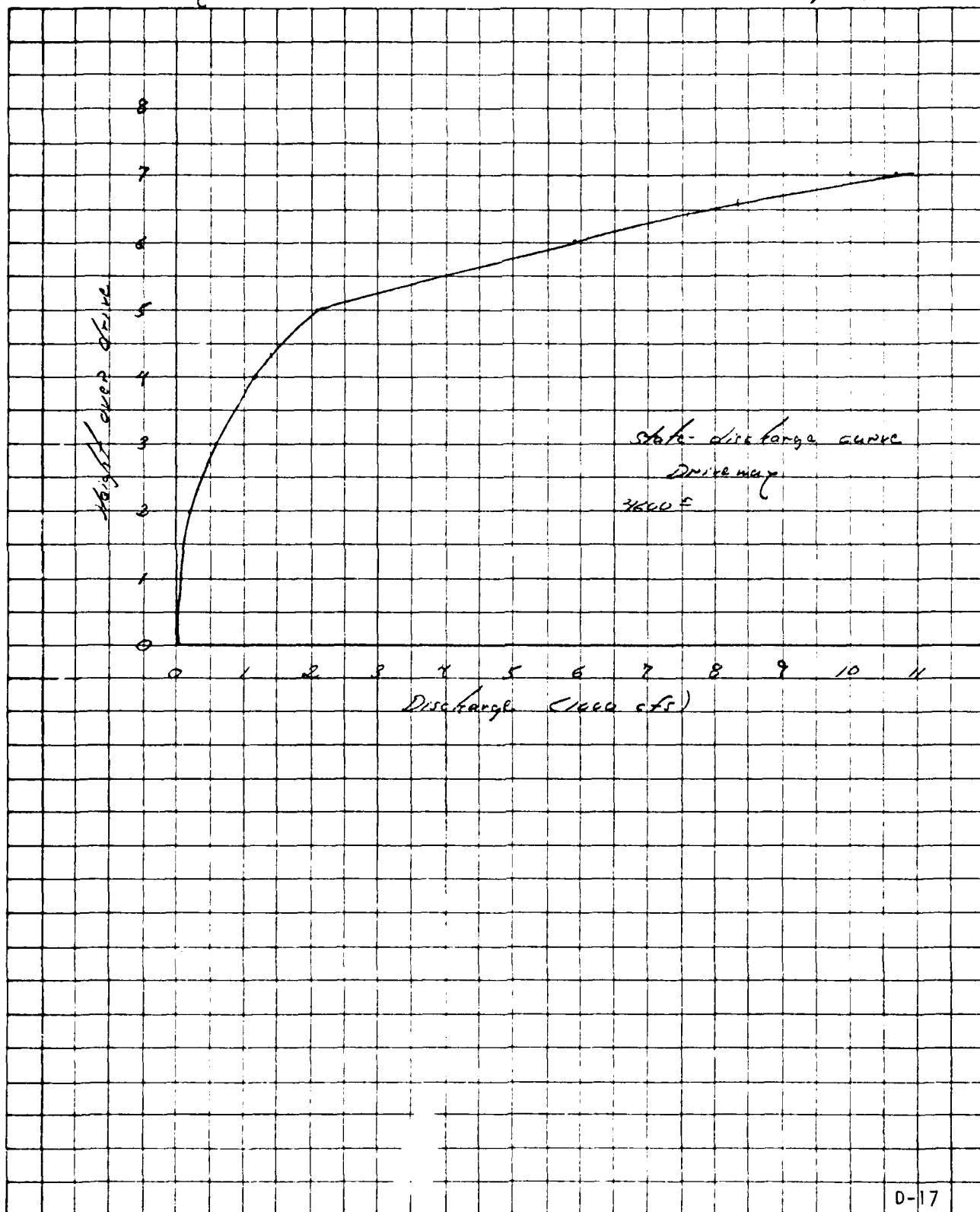
Computation Littleton Reservoir

Job No. 953-05N

Computed by SDM

Checked by MEB

Date 9/29/80



Subject Inspection of non-federal dam

Computation Vandell Reservoir Job No. 953-05N

Computed by SDM Checked by MEB/BW Date 7/29/80

Summary

a) Peak Failure Outflow

$$Q_p = 30,700 \text{ cfs} \quad \text{Peak failure flow} = 1700 \text{ cfs}$$

b) Approximate stage before failure

Vandell Road  $H = 10'$

Town Rd. 4500' D/S  $H = 9'$

Driveway 4600' D/S  $H = 9'$

c) Approximate stage after failure

(Assume roadway embankment remain after pre-failure flow)

Vandell Road  $H = 16.5'$

Town Rd. 4500' D/S  $H = 12'$

Driveway 4600' D/S  $H = 11'$

d) Rise in stage

Vandell Rd.  $16.5' - 10' = 6.5'$

Town Rd.  $12' - 9' = 3'$

Driveway  $11' - 9' = 2'$

e) Effect upon Cox Reservoir (4600'± D/S)

Potential failure in flow to Cox Reservoir  $\approx$

8100 cfs, dam would be approx. 8.8' above spill

or 5.8' above Cox Dam crest. Therefore failure

of Vandell would fail Cox Dam. If Cox Dam

did not fail, D/S flow of 8100± cfs would

be in same range as computed Cox breach flow

of 6870 cfs and hazard would be approximately

the same as with Cox failure - 3 dwellings would

be flooded to a depth of 3 or 4 feet. Cox

current failure of Cox would result in greater damage

to the town.

Subject Inspection of Non-Federal Dams

Computation Vandell Reservoir Woodstock, VT Job No. 953-05N

Computed by BW Checked by \_\_\_\_\_ Date 11-17-80

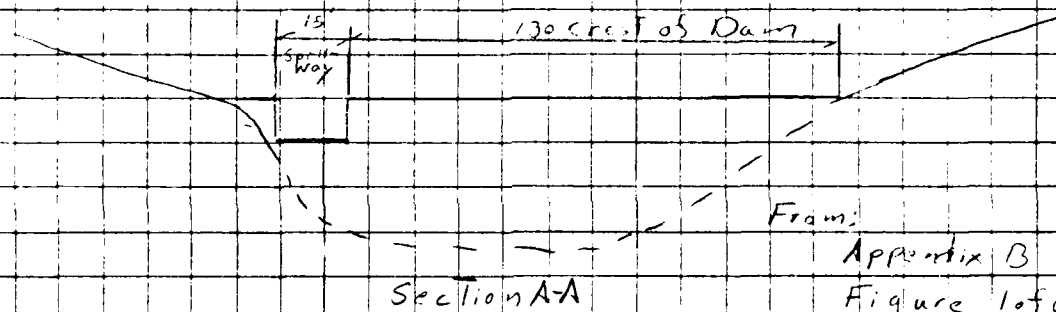
Determine effect of Vandell failure on  
stage of Cox Reservoir.

1 Routed Failure Flow into Cox Reservoir

$$Q_p = 8100 \text{ cfs}$$

2 Dam Section

a) Data from: "Cox District Reservoir Dam, VT 00234  
Phase I Inspection Report National Dam Inspection  
Program", NED-ACE, October 1979



b) Stage Discharge

Because of small spillway capacity in comparison to  
inflow require spillway discharge and treat as full  
length broad crest weir.

$$\text{Then (from Cox pg D-4)} Q = C L H_D^{3/2}$$

$$C = 3.08, L = 130, H_D = H - 4.9 \text{ referenced from spillway crest}$$

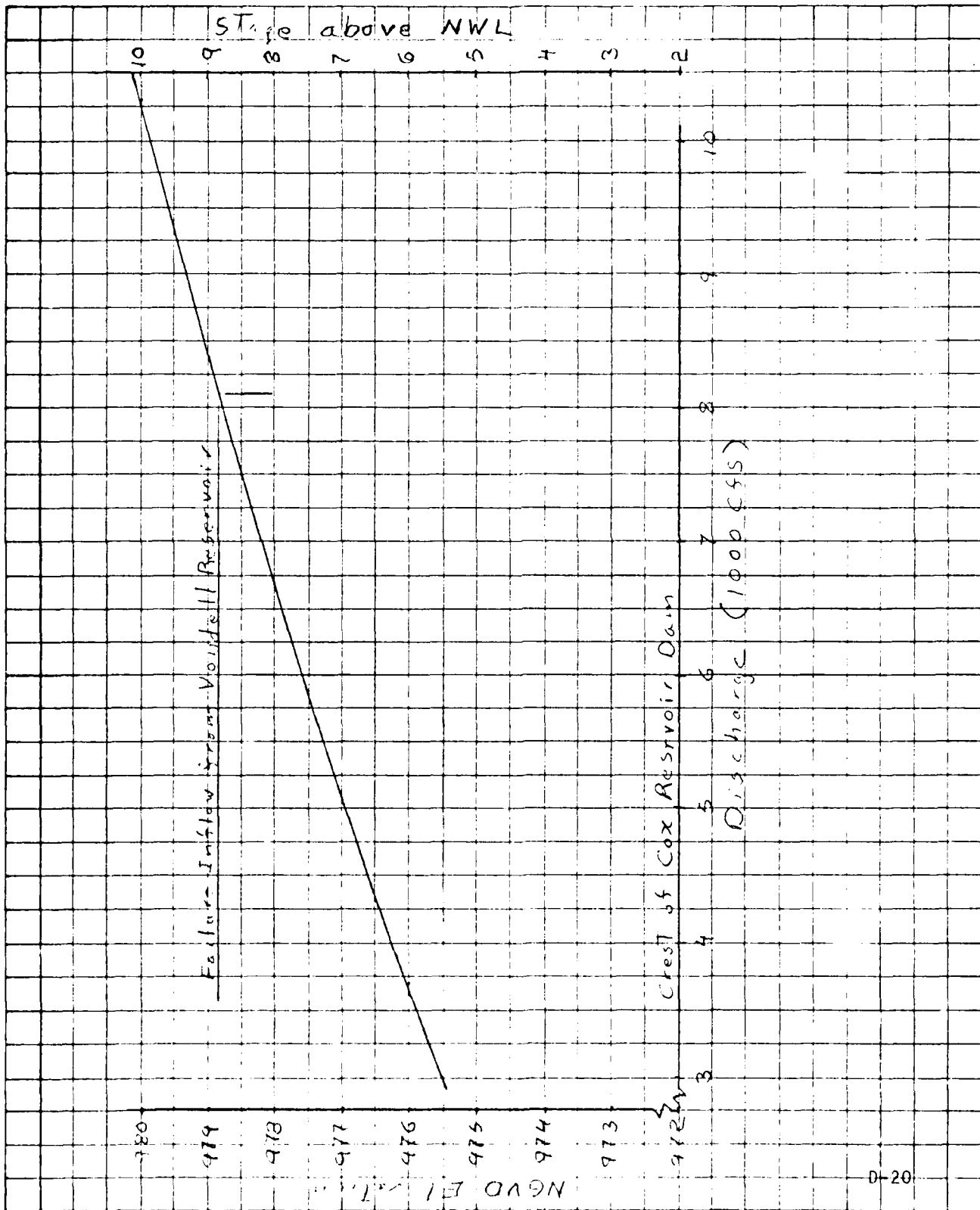
$$Q = (130 + 15)(3.08)(H - 4.9)^{3/2} \quad (\text{Inv. Spillway to Crest} = 4.9')$$

N.W.D.	H	H-4.9	Crest Discharge	Stage Above M.W.L.	N.W.L. = 970
967.0	0	0	0	2	
972	5	0.1	14	4	
974	7	2.1	1360	6	
976	9	4.1	3700	8	
978	11	6.1	6730	10	
980	13	8.1	10350		

Subject Inspection of Non-Federal Dams

Computation Vand. II Reservoir Woodstock VT Job No. 953-05N

Computed by BW Checked by \_\_\_\_\_ Date 11-17-80



PRELIMINARY GUIDANCE  
FOR ESTIMATING  
MAXIMUM PROBABLE DISCHARGES  
IN  
PHASE I DAM SAFETY  
INVESTIGATIONS

New England Division  
Corps of Engineers

March 1978

MAXIMUM PROBABLE FLOOD INFLOWS  
NED RESERVOIRS

<u>Project</u>	<u>Q</u> (cfs)	<u>D.A.</u> (sq. mi.)	<u>MPF</u> cfs/sq. mi.
1. Hall Meadow Brook	26,600	17.2	1,546
2. East Branch	15,500	9.25	1,675
3. Thomaston	158,000	97.2	1,625
4. Northfield Brook	9,000	5.7	1,580
5. Black Rock	35,000	20.4	1,715
6. Hancock Brook	20,700	12.0	1,725
7. Hop Brook	26,400	16.4	1,610
8. Tully	47,000	50.0	940
9. Earre Falls	61,000	55.0	1,109
10. Conant Brook	11,900	7.8	1,525
11. Knightville	160,000	162.0	987
12. Littleville	98,000	52.3	1,870
13. Colebrook River	165,000	118.0	1,400
14. Mad River	30,000	18.2	1,650
15. Sucker Brook	6,500	3.43	1,895
16. Union Village	110,000	126.0	873
17. North Hartland	199,000	220.0	904
18. North Springfield	157,000	158.0	994
19. Ball Mountain	190,000	172.0	1,105
20. Townshend	228,000	106.0(278 total)	820
21. Surry Mountain	63,000	100.0	630
22. Otter Brook	45,000	47.0	257
23. Birch Hill	88,500	175.0	505
24. East Brimfield	73,900	67.5	1,095
25. Westville	38,400	99.5(32 net)	1,200
26. West Thompson	85,000	173.5(74 net)	1,150
27. Hodges Village	35,600	31.1	1,145
28. Buffumville	36,500	26.5	1,377
29. Mansfield Hollow	125,000	159.0	786
30. West Hill	26,000	28.0	928
31. Franklin Falls	210,000	1000.0	210
32. Blackwater	66,500	128.0	520
33. Hopkinton	135,000	426.0	316
34. Everett	68,000	64.0	1,062
35. MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS  
BASED ON TWICE THE  
STANDARD PROJECT FLOOD  
(Flat and Coastal Areas)

<u>River</u>	<u>SPF</u> (cfs)	<u>D.A.</u> (sq. mi.)	<u>MPF</u> (cfs/sq. mi.)
1. Pawtuxet River	19,000	200	190
2. Mill River (R.I.)	8,500	34	500
3. Peters River (R.I.)	3,200	13	490
4. Kettle Brook	8,000	30	530
5. Sudbury River.	11,700	86	270
6. Indian Brook (Hopk.)	1,000	5.9	340
7. Charles River.	6,000	184	65
8. Blackstone River.	43,000	416	200
9. Quinebaug River	55,000	331	330

AD A156 941

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS  
VONDELL RESERVOIR DAM..(U) CORPS OF ENGINEERS WALTHAM  
MA NEW ENGLAND DIV OCT 80

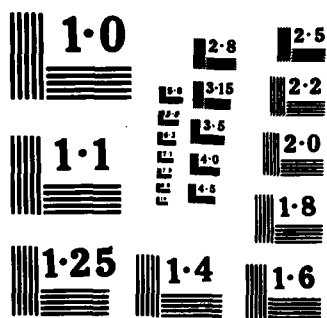
2/2

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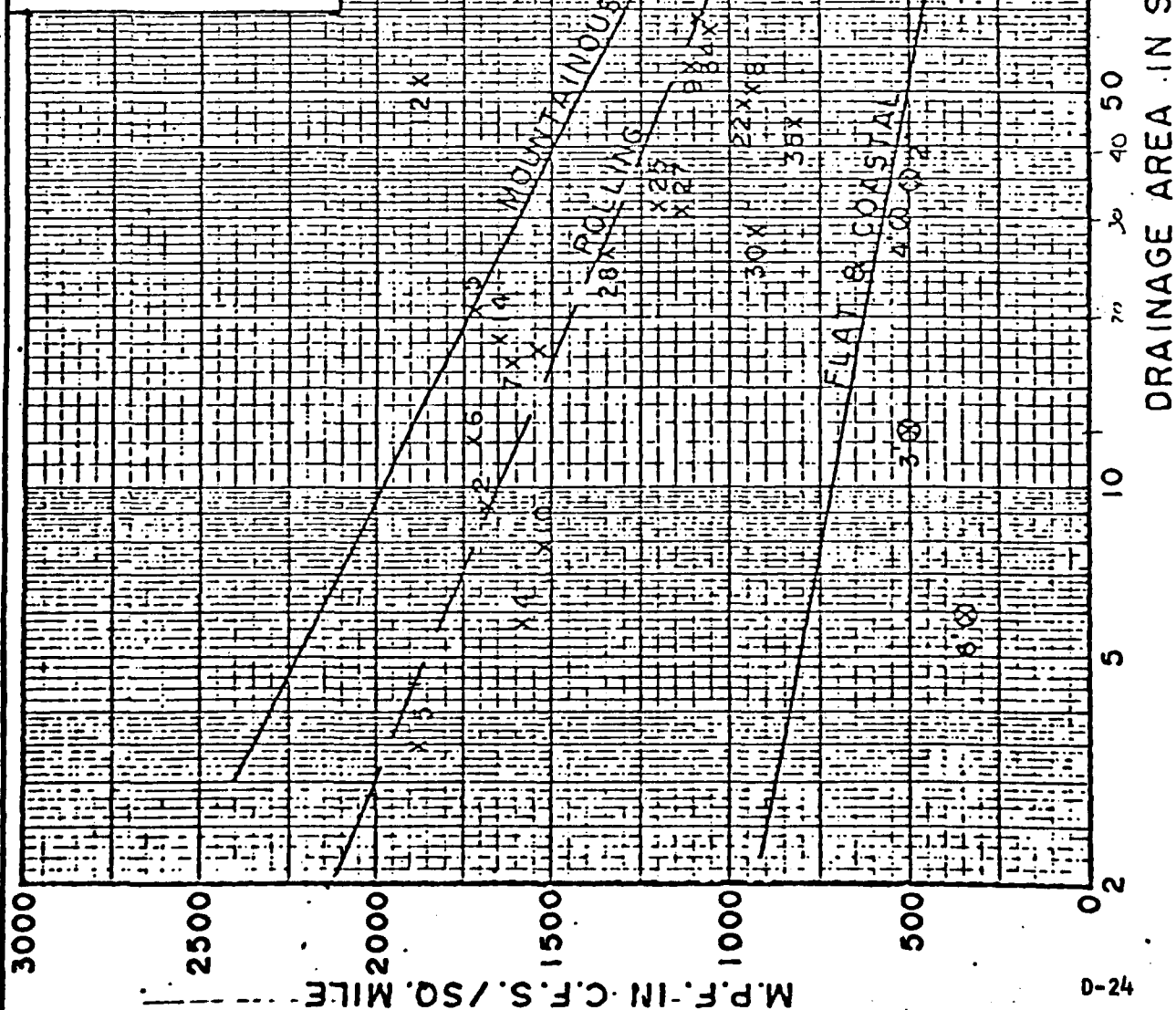
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						END DATE FORMED 8-85
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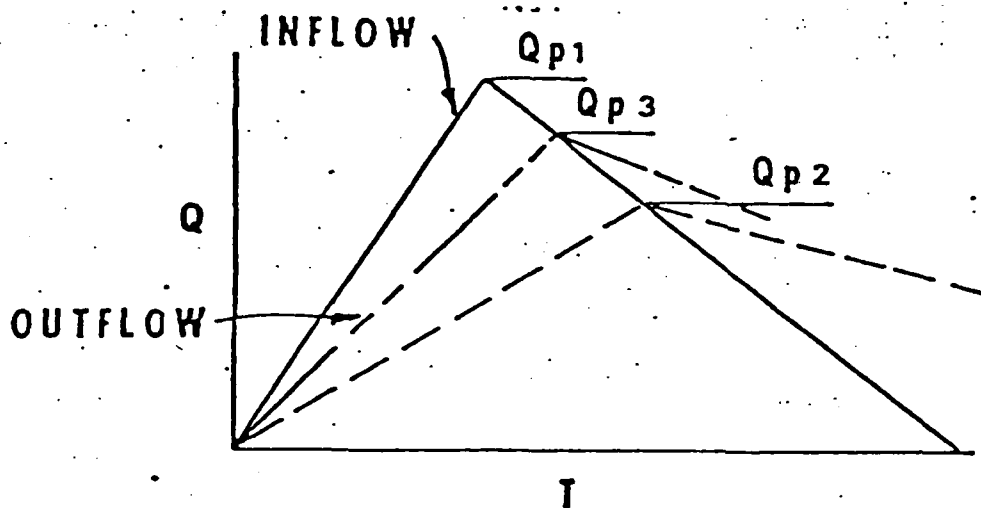


# MAXIMUM PROBABLE FLOOD PEAK FLOW RATES

X 5 - NED DAM IDENTIFICATION  
 O 7' - TWICE SPF AT INDICATED SITES  
 DEC. 1977



# ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow ( $Q_{p1}$ ) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass " $Q_{p1}$ ".

b. Determine Volume of Surcharge ( $STOR_1$ ) In Inches of Runoff.

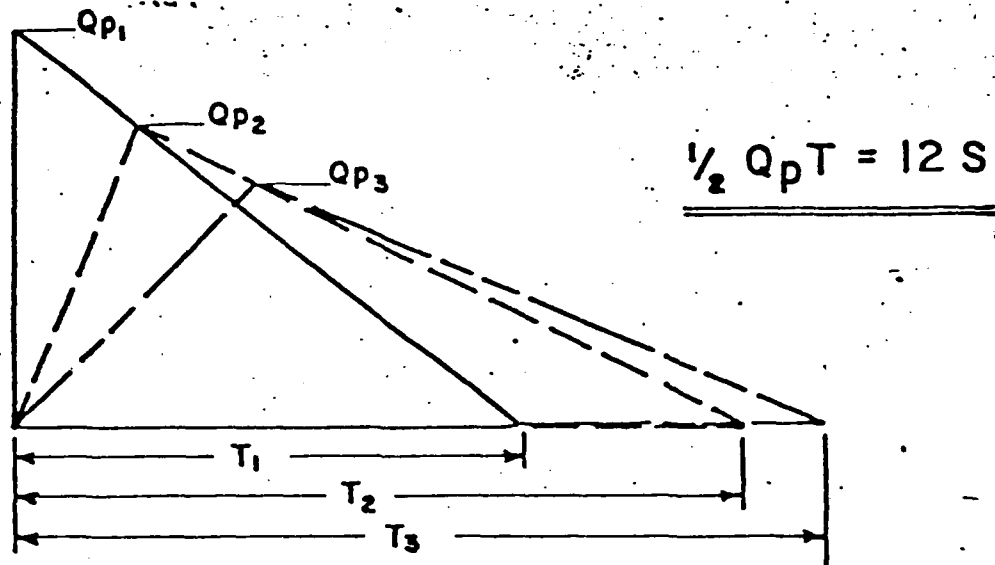
c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore:

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and " $STOR_2$ " To Pass " $Q_{p2}$ "

b. Average " $STOR_1$ " and " $STOR_2$ " and Determine Average Surcharge and Resulting Peak Outflow " $Q_{p3}$ ".

# "RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



**STEP 1:** DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

**STEP 2:** DETERMINE PEAK FAILURE OUTFLOW ( $Q_{p1}$ ).

$$Q_{p1} = \frac{8}{27} W_b \sqrt{Y_0} Y_0^{3/2}$$

$W_b$  = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

$Y_0$  = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

**STEP 3:** USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

**STEP 4:** ESTIMATE REACH OUTFLOW ( $Q_{p2}$ ) USING FOLLOWING ITERATION.

A. APPLY  $Q_{p1}$  TO STAGE RATING, DETERMINE STAGE AND ACCOMPANYING VOLUME ( $V_1$ ) IN REACH IN AC-FT. (NOTE: IF  $V_1$  EXCEEDS  $1/2$  OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL  $Q_{p2}$ .

$$Q_{p2}(\text{TRIAL}) = Q_{p1} \left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE  $V_2$  USING  $Q_{p2}$  (TRIAL).

D. AVERAGE  $V_1$  AND  $V_2$  AND COMPUTE  $Q_{p2}$ .

$$Q_{p2} = Q_{p1} \left(1 - \frac{V_{\text{avg}}}{S}\right)$$

**STEP 5:** FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E  
INFORMATION AS CONTAINED IN  
THE NATIONAL INVENTORY OF DAMS

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# INVENTORY OF DAMS IN THE UNITED STATES

STATE	DIVISION	COUNTY	COUNTY	CONTRACT	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY   MO   YR
VT	100	NEP	VT	027	VONDELL RESERVOIR	4337.7	7234.3	150CT60

POPULAR NAME	NAME OF IMPOUNDMENT			
VONDELL RESERVOIR	VONDELL RESERVOIR			
REGION BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01 0P	VONDELL BROOK	WEST WOODSTOCK	3	

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STILL WATER HEAD (FT.)	HYDRAULIC HEAD (FT.)	IMPOUNDING CAPACITY (ACRE-FT.)
RE	1962	S	33	33	114

DIST OWN FED R PRV/FED SCS A VER/DATE  
N N N N N 150CT60

REMARKS

D/S HAS	SPILLWAY	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CU YD)	POWER CAPACITY (KW)	INSTALLED	PROPOSED	NO.	LENGTH	WIDTH	HEIGHT	LENGTH	WIDTH	HEIGHT	LENGTH	WIDTH	HEIGHT
2	520 U 60	1400	22270													

OWNER	ENGINEERING BY	CONSTRUCTION BY
WOODSTOCK AGRICULT CO	GRATIOT ENGINEERING CO	

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
WATER RESOURCES BD	WATER RESOURCES BD	WATER RESOURCES BD	WATER RESOURCES BD

INSPECTION BY	INSPECTION DATE DAY   MO   YR	AUTHORITY FOR INSPECTION
J W BEMALL CO FOR CORPS OF ENGRS	USAUG60	CONTRACT NO. DACW 33-60-C-0051

REMARKS

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